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Determinants of breastfeeding indicators among children less than 24 months of age in Tanzania: a secondary analysis of 2010 Tanzania Demographic and Health Survey

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Authors' contributions: RV designed the study, performed the analysis, and prepared the manuscript; SKB provided advice on study design, and critically revised the manuscript for intellectual content; KEA provided advice on study design, data-analysis and critically revised the manuscript for intellectual content; and MJD provided advice on study design and critically revised the manuscript for intellectual content.

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Article summary

Article focus

- This paper aims to examine key World Health Organization (WHO) breastfeeding indicators in Tanzania and determine factors associated with delayed initiation of breastfeeding, non-exclusive breastfeeding and predominant breastfeeding practices in children aged 0-23 months.

Key messages

- Prevalence of early initiation and exclusive breastfeeding indicators fell below national targets for Tanzania. A considerable proportion of infants less than 6 months were predominantly breastfed.
- Children who live in the Northern, Southern zones and Zanzibar were at higher risk of sub-optimal breastfeeding practices than children in other geographic zones of Tanzania.
- Young maternal age, lower maternal education, unemployment, home delivery and lack of professional assistance at birth were the main determinants of sub-optimal breastfeeding practices in Tanzania.

Strengths and limitations of the study

- The main limitation was the cross-sectional nature of the survey, which limited inferences about causality from the analyses.
- In addition, exclusive breastfeeding was based on a 24-hour recall rather than a longer recall period, and this short recall may have missed some infants who were fed other liquids or foods prior to the 24 hours before the survey.
- However, the use of a large nationally representative survey sample with very high response rate (96.4%), the appropriate statistical adjustments for survey design and modelling for confounding effects add strength to the validity of the findings. Furthermore, restricting the sample to only children less than 2 years who lived with their mothers helped ensure greater accuracy of information regarding breastfeeding practices.

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Abstract

Objective: To examine the prevalence of key World Health Organization (WHO) breastfeeding indicators and identify determinants of suboptimal breastfeeding practices among children aged less than 24 months in Tanzania.

Design, setting and participants: Secondary analyses of cross-sectional data from the 2010 Tanzania Demographic and Health Survey (TDHS). The survey used a stratified two-stage cluster sample of 10,312 households from eight geographic zones of Tanzania. The sample consisted of 3,112 children aged 0-23 months.

Main outcome measures: Outcome measures were factors significantly associated with delayed initiation of breastfeeding, non-exclusive breastfeeding and predominant breastfeeding in the first six months.

Results: Breastfeeding was initiated within the first hour of birth in 46.1% of mothers. In infants aged less than six months the prevalence of exclusive breastfeeding was 49.9% but only 22.9% were exclusively breastfed at 4-5 months. Seventeen per cent of infants less than 6 months were "predominantly breastfed". At 12-15 months, 94.0% of infants were still breastfed but the proportion decreased to 51.1% at 20-23 months of age. Multivariate analysis revealed that the risk of delayed initiation of breastfeeding within one hour after birth was significantly higher among young, uneducated and unemployed mothers aged <24 years from rural areas who lacked proper care during and after birth. The risk factors associated with non-exclusive breastfeeding during the first six months were lack of professional assistance at birth and residence in urban areas. The risk of predominant breastfeeding was significantly higher among infants from Zanzibar geographic zone

Conclusions: Early initiation of breastfeeding and exclusive breastfeeding indicators were unsatisfactory and are below the national targets for Tanzania. To improve breastfeeding practices will require national level programs but with a focus on the target groups with sub-optimal breastfeeding practices.

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INTRODUCTION

The World Health Organization (WHO)[1] infant feeding guidelines recommend that all infants should be breastfed within 1 hour after birth and exclusively breastfed from birth until 6 months of life. Thereafter infants should be introduced to nutritionally adequate and safe complementary foods with continued breastfeeding for up to two years or beyond. In line with WHO recommendations, Tanzania has been implementing a number of initiatives to improve infant feeding practices, which include the National Strategy and Implementation Plan on Infant and Young Child Nutrition, the Baby Friendly Hospital Initiatives (BFHI) and the training of health workers on infant feeding skills. Despite these efforts, breastfeeding practices and especially the early initiation and exclusive breastfeeding remain suboptimal in Tanzania.[2]

According to the Tanzania Demographic and Health Survey (TDHS) of 2010,[2] breastfeeding was almost universal at 99% in all socio-demographic categories, however, early initiation of breastfeeding within one hour after birth was reported by 46.1% of women who recently delivered a baby, while the prevalence of exclusive breastfeeding (EBF) was 50% among infants less than six months.[2] This implies that a considerable proportion of infants aged less than 6 months are introduced to other liquids and solid foods before the recommended age of 6 months and thereby limiting the full benefits of breastfeeding. Low adherence to optimal breastfeeding including exclusive breast feeding for the first 6 month and risk of diarrheal disease from contaminated complementary foods given to infants well before 6 months of age is believed to contribute to under nutrition observed in young children. For instance, the 2010 TDHS reported that 35% of children under-five years of age were stunted while 21% were under weight indicating that undernutrition is a public health problem in Tanzania that needs to be addressed at a very early stage of infant's life.[2]

It is well established that optimal breastfeeding confers protective effects against gastrointestinal infections and improves child survival.[3-5] A cohort study carried out in Ghana revealed that 22% of neonatal deaths could be prevented if all infants were put to the breast within the first hour of birth.[4] It has also been reported that exclusive breastfeeding from birth and until 6 months of age has the potential to prevent 13% of all deaths among children aged less than 5 years annually in developing countries.[6]

Research investigating the factors associated with suboptimal breastfeeding practices has been conducted in developed and developing countries, including Africa, and shows that

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delayed initiation of breastfeeding after birth and not exclusive breastfeeding during the first 6 months were influenced by factors such as maternal age,[7-9] maternal level of education,[8-10] maternal employment status,[10, 11] maternal nutritional status,[12] place of delivery,[13, 14] mode of delivery,[15-17] area of residence,[16] household wealth status[10] and geographical differences.[16, 18] These factors have been documented to be either positively or negatively associated with breastfeeding practices and the inconsistencies of the results found in different countries make it difficult to generalize the findings to all countries, hence the need to identify factors that are associated with breastfeeding practices in Tanzania.

This secondary data analysis of the 2010 TDHS aims to describe the prevalence of breastfeeding practices using the current WHO breastfeeding indicators,[19] and to determine the factors associated with delayed initiation of breastfeeding, non-exclusive breastfeeding and predominant breastfeeding among children less than 24 months of age in Tanzania.

METHODS

Data source

The present analysis was based on the 2010 Tanzania Demographic and Health Survey (TDHS),[2] which was conducted from December 2009 to May 2010 by the National Bureau of Statistics and the Office of the Chief Government Statistician –Zanzibar in collaboration with the Ministry of Health and Social Welfare. The 2010 TDHS is the eighth in a series of Demographic and Health Surveys conducted in Tanzania. The survey aimed to gather information about child mortality, nutrition, maternal and child health, as well as family planning and other reproductive health issues. The survey sample was designed to provide estimates for the entire country, for both urban and rural areas which comprised of 26 regions from Tanzania mainland and Zanzibar.

Survey design

The 2010 TDHS utilised a cross-sectional study design and the nationally representative survey sample was obtained using stratified two-stage random sampling.[2] In the first stage, 475 clusters were selected from a list of enumeration areas from the 2002 Population and Housing Census.[20] Eighteen clusters were selected in each region except Dar es Salaam, where 25 clusters were selected in the Mainland. In Zanzibar, 18 clusters were selected in each region for a total of 90 sample points. In the second stage, a complete household listing

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was carried out in each of the selected clusters. Twenty-two households were selected from each cluster in all regions except for Dar es Salaam where 16 households were systematically selected. A total of 10,300 households were selected for the sample, of which 10,176 were successfully interviewed, yielding a household response rate of 99%. From these households, 10,522 women of reproductive age (15-49 years) who were either permanent residents of the households in the 2010 TDHS sample or visitors present in the household on the night before the survey were interviewed. Face-to-face interviews were held with the sampled mothers using a structured questionnaire yielding an interview response rate of 96.4%. Comprehensive details regarding the sampling procedure and data collection tools are available in the 2010 TDHS report.[2]

Feeding indicators

The breastfeeding indicators reported in the survey were estimated according to the WHO recommended definitions of the key indicators for assessing infant and young child feeding practices.[19, 21] The indicators include:-

- **"*Early initiation of breastfeeding*:** Proportion of children born in the last 24 months who were put to the breast within one hour of birth-this indicator based on historical recall";
- **"*Exclusive breastfeeding under 6 months*:** Proportion of infants 0-5 months of age who were fed exclusively with breast milk -this indicator is based on mother's recall on feeds given to the infant in the previous day";
- **"*Continued breastfeeding at 1 year*:** Proportion of children 12-15 months of age who were fed breast milk";
- **"*Continued breastfeeding at 2 years*:** Proportion of children 20-23 months of age who were fed breast milk"
- **"*Predominant breastfeeding*:** Proportion of infants 0-5 months of age who were fed with breast milk from the mother (either directly or expressed) and certain liquids (water, water-based drinks and fruit juice), ritual fluids. Infants who received non-human milk and food-based fluids were not included when computing the prevalence of this indicator".

- **"*Children ever breastfed*:** Proportion of children born in the last 24 months who were ever breastfed".

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- **"*Bottle feeding*:** Proportion of children 0-23 months of age who are fed with a bottle"

WHO recommends EBF indicator be disaggregated for the following age groups: 0-1month, 2-3 months, 4-5 months and 0-3 months. Ever breastfed and early initiation of BF indicators were further disaggregated and reported for live births occurring 0-12, 12-23 and 0-23 months prior to interview. It should be noted that the EBF indicator defined above does not represent the percentage of infants who are exclusively breastfed at their sixth month of age[19, 22] but rather the average prevalence of exclusive breastfeeding of children < 6 months of age.

The breastfeeding indicators were examined by individual level factors, which included mother's age, mother's body mass index (BMI) measured by weight (kg)/height (m^2), mother's literacy, mother's working status, mother's education, mother's marital status, partner's education, partner's occupation, birth order, birth interval, sex of child, age of child, size of child, place of delivery, type of delivery assistance, number of antenatal clinic visits, timing of postnatal check-up, mode of delivery, mother's access to mass media; household level factors included household wealth index and mother's autonomy in household decision making; and community level factors included place of residence and geographic zones. The household wealth index was calculated as a score of household assets weighted using the principal components analysis method.[23]

Early initiation of breastfeeding within one hour of birth and exclusive breastfeeding were examined in the multivariate analysis because their prevalence continues to be below the national target and WHO/UNICEF recommendation of 90% coverage.[24, 25] Early initiation of breastfeeding and EBF also play a vital role in protecting infants against diarrhoeal diseases, and reducing mortality among many infants in developing countries.[26] The rates of "ever-breastfed" and "continued breastfeeding" were very high (>90%) hence, they were not included in the multivariate analysis. The indicator for predominant breastfeeding was also included in the multivariate analysis due to its impact on increasing the risk of diarrhoeal and respiratory illness in infants. [26] In addition, bottle feeding was not considered in this analysis because the prevalence was very low (4%).

Data analysis

Our analysis was restricted to the alive, youngest last born infants aged less than 24 months, living with their mothers (women age 15-49 years) during the 2010 TDHS and the total weighted sample was 3,112. The analysis of determinants of early breastfeeding initiation

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was based on the entire sample (3112 children) while those of exclusive breastfeeding and predominant breastfeeding were based on 744 infants aged from 0-5 months. Non-EBF was expressed as a dichotomous variable with category 1 for non- EBF and category 0 for EBF. Delayed initiation of breastfeeding was expressed as a dichotomous variable with category 0 for early initiation of breastfeeding and category 1 for delayed initiation of breastfeeding. Predominant breastfeeding was expressed as a dichotomous variable with category 1 for predominant breastfeeding and category 0 for not predominant breastfeeding. These variables were examined against a set of independent variables (individual, household and community characteristics) in order to determine the prevalence and factors associated with delayed initiation of breastfeeding, non-exclusive breastfeeding and predominant breastfeeding indicators.

Analyses were performed using Stata version 10.0 (Stata- Corp, College Station, TX, USA). 'Svy' commands were used to allow for adjustments for the cluster sampling design, sampling weights and the calculation of standard errors. The Taylor series linearization method was used to estimate confidence intervals around prevalence estimates. A chi-squared test was used to test the significance of associations. Unadjusted and adjusted odds ratios (AOR) were calculated to estimate the strength of association between independent variables and three breastfeeding indicator outcomes: delayed initiation of breastfeeding, non-exclusive breastfeeding and predominant breastfeeding. In our multivariate statistical modelling, we created an indicator variable for missing data and restricted our analysis to non-missing data. Multiple logistic regression using surveys commands was conducted using stepwise backwards elimination of variables in order to determine the factors significantly associated with the outcome breastfeeding indicators. The odds ratios with 95% confidence intervals were calculated in order to assess the adjusted risk of independent variables, and only those with $p<0.05$ were retained in the final model. We did our backward stepwise model by adjusting for sampling weights and clusters. We double-checked our background elimination method by using the following procedure: (1) enter only variable with *P*-value <0.20 in our backward elimination process; (2) tested our backward elimination by also including all variables (all potential confounders); and (3) we tested for collinearity. The linear interpolation method was used to compute the median duration of exclusive breastfeeding.

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RESULTS

Basic characteristics of the sample

Table 1 shows the distribution of 3,112 children aged less than 24 months according to individual-, household-, and community-level characteristics. The majority of children lived in rural areas (79.7%). Many mothers (67.0%) had primary level education, and about 86% were employed in the last 12 months. Eighty-five per cent of the mothers were currently married, and their husband's occupation was dominated by agricultural activities (63.5%). Of all children, more than half (50.9%) were born in health facilities but a relatively low percentage of mothers delivered by caesarean section (5.1%). Most mothers (48.0%) were assisted by health professionals at delivery, and a high proportion of the mothers were multiparous (80.4%). About 48% of mothers had made at least 3 antenatal clinic visits during pregnancy, and 31.4% had post-natal check-ups by 41 days after birth. The gender of the children was nearly equally represented in the sample. Approximately one quarter (22.6%) of the children was from poor families.

[Insert Table 1].

Breastfeeding indicators

Less than half of the mothers (46.1%) had initiated breastfeeding within the first hour after birth, whereas 98.5% reported they had "ever breastfed" their infants (Table 2). There were 49.9% of the infants less than 6 months of age that were exclusively breastfed, but the median duration for exclusive breastfeeding was only 2.6 months. Less than quarters (16.8%) of the infants below six month of age were predominantly breastfed. About 94% of the children were still breastfed at 12-15 months but the percentage decreased to 51.1% at 20-23 months of age. Few children (3.8%) were bottle-fed from birth to 23 months.

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Table 2: Prevalence of breastfeeding indicators among children aged less than 24 months in Tanzania

Indicator	Size of subsample (weighted)	n (weighted)	Rate (%)	[95% CI]	
Early initiation of breastfeeding 0-23 months	3112	1434	46.1	[43.44,	48.76]
Early initiation of breastfeeding 0-11 months	1630	750	46.0	[42.58,	49.45]
Early initiation of breastfeeding 12-23 months	1482	685	46.2	[43.00,	49.43]
Children ever breastfed 0-23 months	3112	3065	98.5	[97.68,	99.00]
Children ever breastfed 0-11 months	1630	1604	98.4	[97.31,	99.07]
Children ever breastfed 12-23 months	1482	1461	98.6	[97.63,	99.11]
Exclusive breastfeeding 0-5 months	837	418	49.9	[45.65,	54.15]
Exclusive breastfeeding 0-1 month	245	197	80.7	[74.13,	85.94]
Exclusive breastfeeding 2-3 months	299	153	51.1	[44.38,	57.80]
Exclusive breastfeeding 4-5 months	293	67	22.9	[17.69,	29.10]
Exclusive breastfeeding 0-3 months	544	350	64.4	[58.82,	69.66]
Predominant breastfeeding 0-5 months	837	141	16.8	[13.46,	20.74]
Continued breastfeeding at 1 year	524	492	94.0	[91.02,	96.09]
Continued breastfeeding at 2 year	419	214	51.1	[45.19,	57.04]
Bottle feeding 0-23 months	3112	200	3.8	[2.97,	4.97]
Bottle feeding 0-5 months	837	39	4.7	[3.06,	7.17]
Bottle feeding 6-11 months	793	43	5.4	[3.75,	7.73]
Bottle feeding 12-23 months	1482	37	2.5	[1.66,	3.83]

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As shown in Figure 1, prevalence of EBF was more than 86% at birth but declined rapidly with age to 23.1% at 6 months. At birth 10.8% of infants were given breast milk plus other fluids, including water, juices, or other milk.

[Insert Figure 1]

Breastfeeding indicators across individual-, household-, and community-level characteristics

As seen in Table 3, early initiation of breastfeeding within the first hour after birth was significantly lower among mothers who delivered at home (34.0%); those who were not assisted by health professional (32.7%); residing in rural areas (42.2%); those from poorest households (39.3%) and living in the Eastern zone (36.5%) and the Northern zone (39.3%). There was a significantly lower prevalence of early initiation of breastfeeding among mothers who delivered by caesarean section (20.9%); those who did not have any postnatal checkups (42.7%); mothers who did not have any autonomy in decision making (43.1%); mothers who were unable to read (38.9%) and those with poor access to mass media including radio (41.5%) and television (44.1%). In contrast, there was a higher prevalence of early initiation of breastfeeding within one hour of birth among mothers from the richest households (62.9%); from the Central (52.0%), Southern Highland (53.0%) and the Western (51.4%) geographic zones; from urban areas (61.2%); who delivered at health facilities (57.7%); who were married to a husband not involved in agricultural activities (54.9%), and those who had a higher level of education (62.7%).

Exclusive breastfeeding of infants aged less than 6 months of age was significantly lower among mothers who had worked in the last 12 months (48.0%); mothers who resided in urban areas (40.3%); those from the richest households (37.0%) and those living in Zanzibar (10.4%). The proportion of infants who were exclusively breastfed for the first 6 months of life were observed to be higher among mothers from rural areas (52.2%) and those living in the Eastern (52.2%), Western (53.6%) and Southern (51.6%) geographic zones. The rates of predominant breastfeeding were not significantly different across individual-, household- and community-level factors.

[Insert Table 3]

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Determinants of breastfeeding indicators

Unadjusted and adjusted odds ratios were calculated to estimate the effect of the independent variables on three infant feeding outcomes: delayed initiation of breastfeeding within the first hour after birth, non-exclusive breastfeeding (non-EBF) and predominant breastfeeding. As seen in Table 4, the adjusted odds of delayed initiation of breastfeeding were significantly higher among infants whose mothers were aged less than 24 years, had a low level of education (no education/primary education), worked in the last 12 months, delivered their babies at home with assistance from untrained provider (traditional birth attendants or relatives/other people) and those who were delivered by caesarean section. The odds of delayed initiation of breastfeeding were also higher for infants from rural compared to infants from urban areas. As compared to infants from the Western geographic zone, infants from Lake, Northern, Eastern and Zanzibar were at higher risk of delayed initiation of breastfeeding within hour after birth.

The odds of non-EBF were significantly higher in infants whose mothers were assisted by traditional birth attendants (TBA) at birth than infants of mothers who were assisted by health professionals. When type of delivery assistant was removed from the final model and replaced by place of delivery, we found that place of delivery was not significantly associated with non-EBF. Hence, type of delivery assistance was retained in the final model. The risk of non-EBF was also significantly higher for urban infants compared to their rural counterparts. As expected, increasing infant age was associated with significantly low rates of EBF. Infants from Zanzibar were at greater risk of non-EBF and predominant breastfeeding compared to infants from other geographic zones

[Insert Table 4]

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DISCUSSION

This study found that less than half of the mothers had initiated breastfeeding within the first hour after birth, and that only half of the mothers exclusively breastfed their infants aged less than 6 months. Seventeen percent of the infants less than 6 months of age were predominately breastfed. We found that lower maternal education, younger maternal age, being employed, delivered at home, delivered by caesarian section, delivery assistance by untrained provider, residing in rural areas of Eastern, Lake, Northern and Zanzibar were determinants of delays in initiation of breastfeeding within first hour after birth. Similarly, delivery assistance by untrained provider and residing in urban areas of Zanzibar were predictors of non-exclusive breastfeeding in the first six months of infant's life. We have also identified the target groups of women who need more breastfeeding support that included young, uneducated, employed women < 25years, women from both rural and urban areas in the Eastern, Lake, Northern and Zanzibar geographic zones, and women who also lacked proper care during and after birth.

This paper is one of the few reports from Africa, including Tanzania, which has described the prevalence of breastfeeding practices using the most recent nationally representative data from Tanzania, and the current WHO recommended definitions for assessing IYCF indicators. The findings from this study will help guide health programs to improve early initiation of breastfeeding, and exclusive breastfeeding in order to ensure young children in Tanzania receive the full benefits of appropriate breastfeeding practises including reduced morbidity and mortality.

The main strengths of this study include the use of a large nationally representative survey sample, with very high response rate to the survey interviews (96.4%), comprehensive data on standard infant feeding indicators to identify factors associated with sub-optimal breastfeeding practices in Tanzania, and appropriate sampling design in the analysis. Furthermore, restriction in children sample to only those who lived with their mothers helped ensure greater accuracy of information regarding breastfeeding practices. The main limitation was the cross-sectional nature of the survey which limited inferences about causality from the analyses. In addition, EBF was based on a 24-hour recall rather than a longer recall period, and this short recall may have missed some infants who were fed other liquids or foods prior to the 24 hours before the survey.

The prevalence of early initiation of breastfeeding has declined from 59% in 2005[27] to 46% in 2010 highlighting the need to reverse this trend and to increase the percentage of initiating breastfeeding within one hour of birth. Similarly, the prevalence of EBF in

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Tanzania was very low in comparison with other neighbouring African countries such as Uganda (60%),[28] Zambia (61%)[29] and Malawi (57%).[30] A considerable proportion (17%) of infants less than 6 months was predominantly breastfed, suggesting a need for counselling mothers, caregivers and key family members on the risks associated with predominant feeding. This strategy would help to change their behaviours which ultimately improve EBF. In our analysis we found a significant association between maternal young age (15-24 years) and delayed initiation of breastfeeding. This result is consistent with findings from India which showed that older mothers (≥35 years) were at lower risk of delayed initiation of breastfeeding compared to young mothers (AOR for older mothers ≥ 35 years= 0.72, 95% CI, 0.50 to 1.02).[13] We further explored this association with parity and found that most of the young mothers in Tanzania were first time mothers, suggesting that they lacked knowledge or experience about appropriate breastfeeding practices. Hence the need for health professionals and traditional birth attendants to provide adequate support to encourage the young and first time mothers to establish early initiation of breastfeeding within 1 hour after giving birth.

Similar to findings reported in India,[13] we also found that women with higher levels of education had a reduced risk of delayed initiation of breastfeeding and this might be explained by their exposure to various sources of information and better knowledge about appropriate infant and young child feeding. The variations in the prevalence of early initiation of breastfeeding across different geographic zones could be due to cultural differences and taboos about breastfeeding newborns with first breast milk (i.e.colostrum) in different regions of Tanzania.[31-33]. A major concern is the very low prevalence of EBF in Lake and Zanzibar geographic zones. This could be due to limited implementation of the Baby Friendly Hospital Initiative (BFHI) in many areas of Tanzania and especially the lack of adequate community component of the BFHI to promote optimal breastfeeding.[34] Provision of adequate support and educating mothers and their families from these zones on the importance of giving the initial breast milk to infants and EBF until 6 months may have a positive effect on improving rates of early initiation of breastfeeding and EBF and potentially reduce the risks of infections and death among newborns.[4].

In this study, rural infants had significantly higher risk of delayed initiation of breastfeeding within 1 hour after birth compared with urban infants. This finding is in agreement with the previous studies from the Morogoro region in Tanzania[31] and from Ethiopia.[35] The difference in early initiation of BF between rural and urban mothers might

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be explained by the high percentage of rural women who delivered at home (93%) assisted by TBAs and other people such as family members. These birth attendants may have had inadequate knowledge of the benefits of this feeding practise and thus failed to support mothers to initiate breastfeeding early. Furthermore, negative cultural beliefs about colostrum and lower level of education among rural mothers (88%) might also have contributed. Rural women may need more support to overcome the barriers to early initiation of especially those living in the Eastern, Lake, Northern and Zanzibar geographic zones. On the other hand, mothers from urban areas were at greater risk of poor EBF practices than mothers from rural areas, possibly because of the demand to return to work after maternity leave [11] since most of these urban mothers were in paid employment. Also most mothers in urban areas were from families with higher socioeconomic status compared to rural areas and that may have facilitated access to breast milk substitutes. For example, data from a multilevel analysis of factors associated with non-EBF in nine East and Southeast Asian countries revealed that improved socioeconomic status both at individual and community levels was a negative factor for EBF.[9]

The risk of delayed initiation of breastfeeding in the first hour after birth was significantly higher among mothers who delivered at home compared to those who delivered at health facilities. Likewise, having a baby not delivered by health professional was a significant predictor of non-EBF. This indicates the need to educate key family members and TBAs about the benefits of initial breast milk for the newborn so that they can encourage mothers who deliver at home to establish breast-feeding immediately after birth and EBF up to 6 months. Exclusive breastfeeding should also be promoted at health facilities during antenatal care visits and during deliveries; and at the community level through peer counselling support for EBF. [36]

Delivery by caesarean section was a risk factor for delayed initiation of breastfeeding in Tanzania. This finding is consistent with previous reports from India,[13] Nepal[37] and Sri-Lanka.[38] This association may be linked to the effects of anaesthesia delaying the onset of lactation.[39] A recent systematic review and meta-analysis of observational studies that examined influence of caesarean delivered on early breastfeeding showed that caesarean delivery has a significant adverse association with early breastfeeding.[17] Appropriate guidelines for caesarean deliveries are needed to minimize delays in initiation of breastfeeding. Prospective mothers and health workers should be informed about the negative

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association between pre-labor caesarean delivery and breastfeeding and the implications for infant well-being. [17]

Our analysis showed a negative association between maternal working status and early initiation of breastfeeding 1 hour after birth. However, our sub-analysis to examine the relationship between maternal working status and mode of delivery found that, mothers who have worked for the past 12 months were significantly more likely to deliver their babies by caesarean-section compared to non-working mothers (74% vs. 26%). Further investigation of this association is needed to provide better understanding of why working mothers in Tanzania delay initiation of breastfeeding 1 hour after birth.

We found that the prevalence of EBF decreased with increasing age of the child. This finding was in conformity with other secondary analyses of Demographic and Health Surveys conducted in Nigeria,[18] India,[13] Bangladesh,[40] Sri-Lanka, Cambodia, Indonesia, Philippines and Timor-Leste, and Vietnam[9] and Malawi[14] which have also reported a declining prevalence of EBF as the age of the child increased. Infants of mothers with no formal education were significantly less likely to be exclusively breastfed than those whose mothers had secondary or higher levels of education. This finding is consistent with many other studies that show low levels of maternal education are associated with low prevalence of EBF in the first six months of life.[41-43] Hence; mothers with lower level of education should be given extra support to help maintain exclusive breastfeeding for at least 6 months.

CONCLUSIONS

The prevalence of breastfeeding indicators regarding early initiation of breastfeeding and EBF were below the national targets (90% coverage)[44] and improvement is needed in order for infants to gain the full benefits of breastfeeding and help the country achieve the Millennium Development Goal for reduction of infant mortality from 51 deaths per 1,000 births in 2010 to 38 deaths per 1,000 live births by the year 2015[2]. The improvement of breastfeeding practices will require national level programs and with a focus on the target groups with sub-optimal breastfeeding practices including young, uneducated mothers who deliver at home assisted by untrained health personnel, and those who deliver by caesarean section. Further research is recommended to investigate why early initiation of breastfeeding is decreasing in Tanzania.

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Data sharing statement: Appendices to the extended report are available in English.

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Appendices

Table 1: Individual, household and community level characteristics for children 0-23 months of age, Tanzania 2010

Table 3: Rates of early initiation of breastfeeding, exclusive breastfeeding and predominant breastfeeding by individual, household and community level characteristics, Tanzania 2010.

Table 4: Unadjusted and adjusted Odds Ratio (OR) for delayed initiation of breastfeeding, non-exclusive breastfeeding and predominant breastfeeding in Tanzania 2010

Figure 1: Distribution of children by breastfeeding status according to age.

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Checklist of items included in this *cross-sectional study*.

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2 & 3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4 & 5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5 & 6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	6 & 7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6 & 8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7
Bias	9	Describe any efforts to address potential sources of bias	*13*
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7 & 8
		(*b*) Describe any methods used to examine subgroups and interactions	8
		(*c*) Explain how missing data were addressed	8
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	8
		(*e*) Describe any sensitivity analyses	8
Results			

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Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	7
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9
		(b) Indicate number of participants with missing data for each variable of interest	8
Outcome data	15*	Report numbers of outcome events or summary measures	9
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	11 & 12
		(*b*) Report category boundaries when continuous variables were categorized	8
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	16
Discussion			
Key results	18	Summarise key results with reference to study objectives	13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14-16
Generalisability	21	Discuss the generalisability (external validity) of the study results	16
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	17

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Table 1: Individual, household and community level characteristics for children 0-23 months of age, Tanzania 2010 (n=3112)

Characteristic	n	%
Individual level factors		
Maternal working status		
Non-working	448	14.4
Working (past 12 mo)	2664	85.6
Maternal education		
No education	799	25.7
Primary	2084	67.0
Secondary and above	229	7.4
Partner's occupation		
Non agriculture	907	29.1
Agriculture	1977	63.5
Not working	229	7.3
Partner's education (n=2889)		
No education	534	18.5
Primary	2079	72.0
Secondary and above	276	9.5
Mother's age		
15-19years	1160	37.3
20-34years	1342	43.1
35-49years	611	19.6
Marital status		
Currently married	2637	84.7
Formerly married (div/sep/widow)	263	8.4
Never married	213	6.8
Birth order		
First-born	611	19.6
2nd-4th	1518	48.8
5 or more	983	31.6
Preceding birth interval (n=3106)		
No previous birth	611	19.7
<24 months	358	11.5
>24 months	2137	68.8
Sex of baby		
Male	1539	49.5
Female	1573	50.6
Child's age in months		
0-5 months	837	26.9
6-11 months	793	25.5
12-17 months	772	24.8
18-23 months	710	22.8
Place of delivery		
Home	1528	49.1

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Health facility	584	50.9
Mode of delivery (n=3107)		
Non-caesarean	2949	94.9
Caesarean section	158	5.1
Type of delivery assistance (n=3105)		
Health professional	1487	47.9
Traditional birth attendant.	388	12.5
Relatives or untrained people	1229	39.6
Antenatal Clinic visits (n=3104)		
None	65	2.1
1-3 visits	1839	59.2
4+ visits	1201	38.7
Timing of postnatal check-up (n=3058)		
No check-ups (including missing)	2097	68.6
0-2 days	466	15.2
3-6 days	176	5.8
7+ days	319	10.4
Mother's BMI(kg/m^2)		
<=18.5	303	9.7
>18.5 - <=24.9	2277	73.2
>24.9 - <=29.9	397	12.8
>=30	135	4.3
Mother's literacy(n=3084)		
Can't read	1273	41.3
Can read	1812	58.7
Mother's frequency of reading newspaper (n=3109)		
Not at all	2702	86.9
Yes	407	13.1
Mother's frequency of listening to radio (n=3109)		
Not at all	1509	48.6
Yes	1600	51.5
Mother's frequency of watching TV		
Not at all	2669	85.8
Yes	443	14.2
Household level factors		
Wealth Index		
Poorest (lowest quintile)	656	21.1
Poorer	751	24.1
Middle	675	21.7
Richer	581	18.7
Richest (highest quintile)	450	14.5
Decisions women have final say		
None	1383	44.4
One-two	577	18.5
Three-four	459	14.8
Five and more	693	22.3

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Community level factors		
Residence		
Urban	631	20.3
Rural	2481	79.7
Geographical Zone		
Northern	451	14.5
Eastern	514	16.5
Western	496	15.9
Southern Highlands	346	11.1
Lake	405	13.0
Southern	222	7.1
Central	594	19.1
Zanzibar	84	2.7
Total	**3112**	**100.0**

Weighted total was 3112 otherwise stated within brackets.

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Table 3 Rates of early initiation of breastfeeding, exclusive breastfeeding and predominant breastfeeding by individual, household and community level characteristics, Tanzania 2010.

Characteristic	Early initiation of BF rate (0-23 months)			Exclusive breastfeeding rate (<6 months)			Predominant breast feeding (<6 months)		
	%	95% CI	p	%	95% CI	p	%	95% CI	p
Individual level factors									
Maternal working status									
Working (past 12 months)	43.2	[40.49,45.97]	<0.001	48.0	[43.23,52.75]	0.035	17.0	[13.29,21.37]	
Non-working	63.2	[57.15,68.93]		58.9	[49.92,67.39]		16.0	[10.12,24.47]	
Maternal education									
No education	41.7	[36.23,47.30]	<0.001	50.6	[41.94,59.29]		17.6	[11.74,25.78]	
Primary	45.9	[42.91,49.04]		49.8	[44.54,55.04]		17.2	[13.47,21.57]	
Secondary and above	62.7	[55.11,69.73]		47.8	[34.17,61.70]		8.6	[4.104,17.29]	
Partner's education									
No education	45.2	[39.65,50.83]	<0.001	50.3	[36.44,64.07]		24.3	[14.36,38.01]	
Primary	43.7	[40.77,46.64]		52.1	[47.05,57.03]		15.1	[11.69,19.23]	
Secondary and above	62.0	[53.78,69.60]		37.3	[23.76,53.23]		15.5	[7.766,28.65]	
Partner's occupation									
Non agriculture	54.9	[50.08,59.59]	<0.001	49.6	[42.05,57.24]		15.6	[10.78,21.90]	
Agriculture	41.4	[38.52,44.41]		50.7	[44.90,56.55]		18.1	[13.82,23.23]	
Not working	51.5	[43.70,59.26]		44.6	[32.33,57.64]		11.8	[4.373,28.06]	
Mother's age									
15-24years	43.5	[39.63,47.47]	0.027	50.4	[44.38,56.49]		17.0	[12.31,23.03]	
25-34years	49.5	[45.68,53.37]		50.4	[43.73,57.03]		15.3	[10.83,21.29]	
35-49years	43.5	[38.85,48.19]		47.5	[37.96,57.23]		19.5	[12.75,28.69]	
Marital status									
Currently married	45.5	[42.64,48.30]		51.0	[46.12,55.91]		17.3	[13.60,21.71]	
Formerly married (div/sep/widow)	47.0	[39.2,54.98]		42.1	[28.10,57.43]		16.8	[7.713,32.91]	
Never married	52.9	[44.58,60.98]		44.5	[32.09,57.53]		11.9	[4.40,28.23]	

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Birth order							
First-born	47.4	[41.98,52.88]		50.1	[41.42,58.79]	13.1	[7.191,22.59]
2nd-4th	47.9	[44.32,51.67]		49.9	[44.19,55.65]	19.0	[14.73,24.14]
5 or more	42.4	[50.91,58.96]		49.7	[42.44,57.01]	15.8	[11.16,22.07]
Preceding birth interval							
No previous birth	47.4	[41.98,52.88]		50.1	[41.42,58.79]	13.1	[7.191,22.59]
<24 months	40.6	[33.62,47.91]		55.4	[43.14,67.03]	22.0	[14.18,32.58]
>24 months	46.7	[43.67,49.82]		48.8	[44.08,53.70]	16.9	[13.48,21.14]
Sex of baby							
Male	44.8	[41.32,48.24]		50.2	[44.47,55.87]	17.9	[13.76,23.14]
Female	47.4	[44.02,50.81]		49.6	[43.51,55.71]	15.5	[11.47,20.72]
Place of delivery							
Home	34.0	[30.99,37.21]	<0.001	50.4	[43.59,57.22]	18.3	[13.88,23.82]
Health facility	57.7	[54.19,61.19]		49.4	[44.38,54.37]	15.2	[11.07,20.58]
Mode of delivery							
Non-caesarean	47.4	[44.60,50.29]	<0.001	49.5	[45.16,53.89]	17.3	[13.88,21.37]
Caesarean section	20.9	[14.12,29.79]		60.1	[40.33,77.14]	4.6	[1.21,16.26]
Type of delivery assistance							
Health professional	58.6	[55.02,62.26]	<0.001	51.1	[45.68,56.43]	14.9	[10.62,20.72]
Traditional birth attendant.	40.2	[34.34,46.37]		40.8	[29.14,53.54]	24.6	[15.41,36.96]
Relatives or untrained people	32.7	[29.35,36.29]		51.1	[44.00,58.05]	16.5	[12.26,21.87]
Antenatal Clinic visits							
None	52.5	[36.46,68.08]	<0.001	47.3	[17.12,79.59]	14.4	[3.594,43.15]
1-3.	42.3	[39.39,45.35]		48.9	[43.89,54.06]	17.5	[13.76,21.87]
4+	51.6	[47.87,55.41]		52.3	[45.13,59.31]	15.3	[10.50,21.86]
Timing of postnatal check-up							
0-2 days	54.9	[49.44,60.41]	<0.001	44.6	[34.89,54.74]	20.8	[13.06,31.58]
3-6 days	62.9	[53.53,71.32]		61.7	[41.52,78.61]	13.7	[4.598,34.17]
7+	51.1	[44.49,57.67]		42.8	[29.27,57.44]	20.9	[10.96,36.18]

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No check-ups (including missing)	41.7	[38.64,44.90]		50.9	[45.45,56.37]		16.1	[12.49,20.51]
Mother's literacy								
Can't read	38.9	[35.07,42.88]	<0.001	47.8	[41.59,54.16]		18.6	[13.80,24.68]
Can read	51.1	[47.73,54.38]		51.4	[45.66,57.02]		15.5	[11.75,20.25]
Mother's frequency of reading newspaper								
Not all	44.0	[41.22,46.88]	<0.001	51.0	[46.49,55.53]		16.8	[13.28,21.08]
Yes	59.8	[53.65,65.62]		41.4	[28.78,55.30]		16.8	[8.743,29.86]
Mother's frequency of listening radio								
Not all	41.5	[38.13,45.13]	0.003	53.2	[46.94,59.4]		17.0	[12.27,23.13]
Yes	50.4	[46.96,53.89]		46.1	[34.27,44.69]		16.7	[12.61,21.71]
Mother's frequency of watching TV								
Not all	44.1	[41.32,46.92]	<0.001	51.9	[47.11,56.57]	0.008	16.9	[13.40,21.24]
Yes	58.1	[51.50,64.42]		33.9	[23.61,46.05]		15.4	[8.335,26.73]
Mother's BMI(kg/m^2)								
<=18.5	48.4	[40.60,56.18]		54.8	[38.25,70.37]		15.4	[5.26,37.45]
>18.5	45.9	[43.15,48.57]		49.7	[45.24,54.05]		16.9	[13.39,21.02]
Household level factors								
Wealth Index								
Poorest (lowest quintile)	39.3	[34.56,44.22]	<0.001	58.3	[49.21,66.83]	0.028	16.9	[11.13,24.76]
Poorer	42.0	[37.14,47.03]		54.0	[44.94,62.87]		19.6	[13.21,28.11]
Middle	43.8	[38.64,49.07]		51.5	[42.35,60.52]		16.4	[10.53,24.54]
Richer	48.7	[42.19,55.26]		42.5	[33.80,51.61]		17.0	[10.85,25.70]
Richest (highest quintile)	62.9	[56.37,69.06]		37.0	[27.07,48.20]		10.9	[5.086,21.96]
Mother's decision in category								
None	43.1	[39.73,46.54]	0.018	46.6	[40.62,52.77]		19.2	[14.02,25.61]
One.	44.7	[39.85,49.71]		47.8	[37.41,58.46]		17.9	[10.94,27.82]
Two.	51.7	[46.14,57.21]		59.0	[48.10,69.10]		14.8	[9.053,23.18]
Three and more	49.5	[44.41,54.58]		52.9	[44.62,61.03]		12.1	[7.334,19.31]
Community level factors								
Residence								

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Urban	61.2	[54.61,67.47]	<0.001	40.3	[31.06,50.27]	0.034	12.4	[6.75,21.60]
Rural	42.2	[39.47,45.06]		52.2	[47.44,56.92]		17.9	[14.13,22.30]
Geographical Zone								
Northern	39.3	[33.99,44.94]	0.001	44.3	[36.74,52.08]	0.002	18.0	[11.37,27.24]
Eastern	36.5	[30.50,43.15]		66.5	[57.66,74.28]		17.1	[10.45,26.76]
Western	51.4	[44.97,57.68]		53.6	[40.87,65.85]		10.7	[4.96,21.40]
Southern Highlands	53.0	[46.95,58.99]		46.4	[36.39,56.71]		11.6	[5.96,21.61]
Lake	44.2	[36.53,52.17]		40.6	[25.90,57.23]		21.1	[9.46,40.53]
Southern	45.4	[35.66,55.53]		51.6	[36.76,66.24]		13.2	[6.28,25.67]
Central	52.1	[44.65,59.52]		48.9	[39.96,57.85]		19.7	[12.34,30.07]
Zanzibar	49.1	[44.23,53.90]		10.4	[6.218,16.73]		36.7	[29.52,44.57]

Note: BMI, body mass index; CI, confidence interval; TV, television. Chi-squire test was applied to test for statistical significance.

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Table 4: Unadjusted and adjusted Odds Ratio (OR) for delayed initiation of breastfeeding, non-exclusive breastfeeding and predominant breastfeeding in Tanzania 2010

Outcome variable	Characteristic	Unadjusted odds ratios			Adjusted* odds ratios		
		OR	[95%CI]	*p*	AOR	[95%CI]	*p*
Delay initiation of breastfeeding							
	Mother's age						
	15-24 years	1.0			1.0		
	25-34 years	0.7	[0.61, 0.91]	0.003	0.6	[0.52, 0.81]	<0.001
	35-49 years	0.9	[0.76, 1.26]		0.7	[0.55, 0.94]	0.016
	Work status						
	Not working	1.0			1.0		
	Working	2.5	[1.88, 3.31]	<0.001	2.3	[1.62, 3.29]	<0.001
	Mother's education						
	No education	1.0			1.0		
	Primary	0.8	[0.65, 1.09]		1.0	[0.77, 1.32]	
	Secondary or more	0.4	[0.26, 0.60]	<0.001	0.5	[0.33, 0.83]	0.006
	Place of delivery						
	Health facility	1.0			1.0		
	Home	2.8	[2.26, 3.38]	<0.001	1.7	[1.09, 2.62]	0.020
	Mode of delivery						
	Non-caesarean	1.0			1.0		
	Caesarean section	3.2	[1.91,5.35]	<0.001	8.9	[4.72,16.79]	<0.001
	Delivery assistant						
	Health professional	1.0			1.0		
	TBA	2.2	[1.65,2.99]	<0.001	1.4	[0.82,2.28]	
	Relatives/others	3.0	[2.42,3.77]	<0.001	1.9	[1.21,3.08]	0.006
	Area of residence						
	Urban	1.0			1.0		
	Rural	2.2	[1.62,3.10]	<0.001	1.4	[1.00,2.03]	0.047

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	Geographic zone						
	Western	1.0			1.0		
	Southern Highlands	1.0	[0.67,1.43]		1.1	[0.70,1.65]	
	Central	1.0	[0.69,1.54]		1.2	[0.81,1.76]	
	Lake	1.4	[0.92,2.21]		1.6	[1.02,2.45]	0.042
	Southern	1.5	[0.87,2.45]		1.6	[0.94,2.73]	
	Northern	1.6	[1.13,2.34]	0.009	1.7	[1.14,2.46]	0.009
	Zanzibar	1.1	[0.80,1.55]		2.3	[1.48,3.68]	<0.001
	Eastern	1.9	[1.26,2.80]	0.002	2.1	[1.37,3.26]	0.001
Non-Exclusive breastfeeding							
	Child age in months (<6mo)	1.9	[1.65, 2.18]	<0.001	2.1	[1.78,2.40]	<0.001
	Delivery Assistance						
	Health professional	1.0			1.0		
	Relatives/other people	1.0	[0.69, 1.47]		1.4	[0.82,2.23]	
	Traditional birth attendants	1.7	[0.98, 3.07]	0.050	2.3	[1.15, 4.57]	0.019
	Area of residence						
	Rural	1.0			1.0		
	Urban	1.5	[0.89, 2.36]		2.1	[1.08, 3.89]	0.028
	Geographical Zone						
	Central	1.0			1.0		
	Eastern	0.4	[0. 19,0.66]	0.001	0.3	[0.17,0.62]	0.001
	Western	0.7	[0.37,1.39]		0.6	[0.32,1.28]	
	Northern	1.1	[0.68,1.86]		1.4	[0.73,2.77]	
	Southern Highlands	1.1	[0.65,2.02]		1.6	[0.84,3.13]	
	Southern	1.0	[0.43,2.17]		1.4	[0.50,3.64]	
	Lake	1.4	[0.58,3.58]		2.6	[0.91,7.29]	
	Zanzibar	8.0	[4.01,15.79]	<0.001	10.8	[5.23,22.22]	<0.001

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Predominant breastfeeding							
	Geographic Zone						
	Western	1.0			1.0		
	Southern Highlands	1.5	[0.45,4.82]		1.5	[0.45,4.82]	
	Southern	1.6	[0.47,5.68]		1.6	[0.47,5.68]	
	Eastern	1.8	[0.57,5.38]		1.8	[0.57,5.38]	
	Central	2.4	[0.79,7.17]		2.4	[0.79,7.17]	
	Northern	2.3	[0.76,6.82]		2.3	[0.76,6.82]	
	Lake	2.6	[0.61,11.03]		2.6	[0.61,11.03]	
	Zanzibar	4.8	[1.76,13.22]	0.002	4.8	[1.76,13.22]	0.002

Note: chi-squire test was applied to test for statistical significance. The independent variables adjusted for included child sex, child age, mother's age, mother's literacy, mother's employment status, mother's BMI, marital status, father's education, father's occupation, birth order, preceding birth interval, antenatal visits, postnatal visits, mother's access to media (radio, television and newspapers), household wealth index, area of residence and geographical zones.

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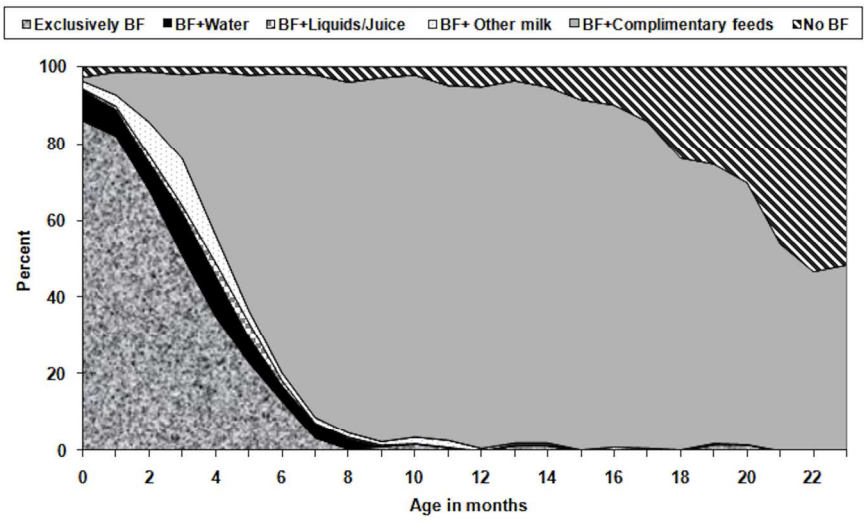

Figure 1: Distribution of children by breastfeeding status according to age

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Determinants of breastfeeding indicators among children less than 24 months of age in Tanzania: a secondary analysis of 2010 Tanzania Demographic and Health Survey

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Determinants of breastfeeding indicators among children less than 24 months of age in Tanzania: a secondary analysis of 2010 Tanzania Demographic and Health Survey

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Article summary

Article focus

- This paper aims to examine key World Health Organization (WHO) breastfeeding indicators in Tanzania and determine factors associated with delayed initiation of breastfeeding, non-exclusive breastfeeding and predominant breastfeeding practices in children aged 0-23 months.

Key messages

- Prevalence of early initiation and exclusive breastfeeding indicators fell below national targets for Tanzania. A considerable proportion of infants less than 6 months were predominantly breastfed.
- Children who live in the Northern, Southern zones and Zanzibar were at higher risk of sub-optimal breastfeeding practices than children in other geographic zones of Tanzania.
- Young maternal age, lower maternal education, employment, home delivery and lack of professional assistance at birth were the main determinants of sub-optimal breastfeeding practices in Tanzania.

Strengths and limitations of the study

- The main limitation was the cross-sectional nature of the survey, which limited inferences about causality from the analyses.
- In addition, exclusive breastfeeding was based on a 24-hour recall rather than a longer recall period, and this short recall may have missed some infants who were fed other liquids or foods prior to the 24 hours before the survey.
- However, the use of a large nationally representative survey sample with very high response rate (96.4%), the appropriate statistical adjustments for survey design and modelling for confounding effects add strength to the validity of the findings. Furthermore, restricting the sample to only children less than 2 years who lived with their mothers helped ensure greater accuracy of information regarding breastfeeding practices.

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Abstract

Objective: To examine the prevalence of key World Health Organization (WHO) breastfeeding indicators and identify determinants of suboptimal breastfeeding practices among children aged less than 24 months in Tanzania.

Design, setting and participants: Secondary analyses of cross-sectional data from the 2010 Tanzania Demographic and Health Survey (TDHS). The survey used a stratified two-stage cluster sample of 10,312 households from eight geographic zones of Tanzania. The sample consisted of 3,112 children aged 0-23 months.

Main outcome measures: Outcome measures were factors significantly associated with delayed initiation of breastfeeding, non-exclusive breastfeeding and predominant breastfeeding in the first six months.

Results: Breastfeeding was initiated within the first hour of birth in 46.1% of mothers. In infants aged less than six months the prevalence of exclusive breastfeeding was 49.9% but only 22.9% were exclusively breastfed at 4-5 months. Seventeen per cent of infants less than 6 months were "predominantly breastfed". At 12-15 months, 94.0% of infants were still breastfed but the proportion decreased to 51.1% at 20-23 months of age. Multivariate analysis revealed that the risk of delayed initiation of breastfeeding within one hour after birth was significantly higher among young mothers aged <24 years, uneducated and employed mothers from rural areas who delivered by caesarean section and those who delivered at home and were assisted by traditional birth attendants or relatives. The risk factors associated with non-exclusive breastfeeding during the first six months were lack of professional assistance at birth and residence in urban areas. The risk of predominant breastfeeding was significantly higher among infants from Zanzibar geographic zone

Conclusions: Early initiation of breastfeeding and exclusive breastfeeding indicators were unsatisfactory and are below the national targets for Tanzania. To improve breastfeeding practices will require national level programs but with a focus on the target groups with sub-optimal breastfeeding practices.

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INTRODUCTION

The World Health Organization (WHO)[1] infant feeding guidelines recommend that all infants should be breastfed within 1 hour after birth and exclusively breastfed from birth until 6 months of life. Thereafter infants should be introduced to nutritionally adequate and safe complementary foods with continued breastfeeding for up to two years or beyond. In line with WHO recommendations, Tanzania has been implementing a number of initiatives to improve infant feeding practices, which include the National Strategy and Implementation Plan on Infant and Young Child Nutrition, the Baby Friendly Hospital Initiatives (BFHI) and the training of health workers on infant feeding skills. Despite these efforts, breastfeeding practices and especially the early initiation and exclusive breastfeeding remain suboptimal in Tanzania.[2]

According to the Tanzania Demographic and Health Survey (TDHS) of 2010,[2] breastfeeding was almost universal at 99% in all socio-demographic categories, however, early initiation of breastfeeding within one hour after birth was reported by 46.1% of women who recently delivered a baby, while the prevalence of exclusive breastfeeding (EBF) was 50% among infants less than six months.[2] This implies that a considerable proportion of infants aged less than 6 months are introduced to other liquids and solid foods before the recommended age of 6 months and thereby limiting the full benefits of breastfeeding. Low adherence to optimal breastfeeding including exclusive breast feeding for the first 6 month and risk of diarrheal disease from contaminated complementary foods given to infants well before 6 months of age is believed to contribute to under nutrition observed in young children. For instance, the 2010 TDHS reported that 35% of children under-five years of age were stunted while 21% were under weight indicating that undernutrition is a public health problem in Tanzania that needs to be addressed at a very early stage of infant's life.[2]

It is well established that optimal breastfeeding confers protective effects against gastrointestinal infections and improves child survival.[3-5] A cohort study carried out in Ghana revealed that 22% of neonatal deaths could be prevented if all infants were put to the breast within the first hour of birth.[4] It has also been reported that exclusive breastfeeding from birth and until 6 months of age has the potential to prevent 13% of all deaths among children aged less than 5 years annually in developing countries.[6]

Research investigating the factors associated with suboptimal breastfeeding practices has been conducted in developed and developing countries, including Africa, and shows that

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delayed initiation of breastfeeding after birth and not exclusive breastfeeding during the first 6 months were influenced by factors such as maternal age,[7-9] maternal level of education,[8-10] maternal employment status,[10, 11] maternal nutritional status,[12] place of delivery,[13, 14] mode of delivery,[15-17] area of residence,[16] household wealth status[10] and geographical differences.[16, 18] These factors have been documented to be either positively or negatively associated with breastfeeding practices and the inconsistencies of the results found in different countries make it difficult to generalize the findings to all countries, hence the need to identify factors that are associated with breastfeeding practices in Tanzania.

This secondary data analysis of the 2010 TDHS aims to describe the prevalence of breastfeeding practices using the current WHO breastfeeding indicators,[19] and to determine the factors associated with delayed initiation of breastfeeding, non-exclusive breastfeeding and predominant breastfeeding among children less than 24 months of age in Tanzania.

METHODS

Data source

The present analysis was based on the 2010 Tanzania Demographic and Health Survey (TDHS),[2] which was conducted from December 2009 to May 2010 by the National Bureau of Statistics and the Office of the Chief Government Statistician –Zanzibar in collaboration with the Ministry of Health and Social Welfare. The 2010 TDHS is the eighth in a series of Demographic and Health Surveys conducted in Tanzania. The survey aimed to gather information about child mortality, nutrition, maternal and child health, as well as family planning and other reproductive health issues. The survey sample was designed to provide estimates for the entire country, for both urban and rural areas which comprised of 26 regions from Tanzania mainland and Zanzibar.

Survey design

The 2010 TDHS utilised a cross-sectional study design and the nationally representative survey sample was obtained using stratified two-stage random sampling.[2] In the first stage, 475 clusters were selected from a list of enumeration areas from the 2002 Population and Housing Census.[20] Eighteen clusters were selected in each region except Dar es Salaam, where 25 clusters were selected in the Mainland. In Zanzibar, 18 clusters were selected in each region for a total of 90 sample points. In the second stage, a complete household listing

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was carried out in each of the selected clusters. Twenty-two households were selected from each cluster in all regions except for Dar es Salaam where 16 households were systematically selected. A total of 10,300 households were selected for the sample, of which 10,176 were successfully interviewed, yielding a household response rate of 99%. From these households, 10,522 women of reproductive age (15-49 years) who were either permanent residents of the households in the 2010 TDHS sample or visitors present in the household on the night before the survey were interviewed. Face-to-face interviews were held with the sampled mothers using a structured questionnaire yielding an interview response rate of 96.4%. Comprehensive details regarding the sampling procedure and data collection tools are available in the 2010 TDHS report.[2]

Feeding indicators

There are fifteen indicators recommended by WHO [19, 21] for assessing infant and young child feeding practices. The breastfeeding indicators reported in the survey include:-

- "***Early initiation of breastfeeding*****:** Proportion of children born in the last 24 months who were put to the breast within one hour of birth-this indicator based on historical recall";
- "***Exclusive breastfeeding under 6 months*****:** Proportion of infants 0-5 months of age who were fed exclusively with breast milk -this indicator is based on mother's recall on feeds given to the infant in the previous day";
- "***Continued breastfeeding at 1 year*****:** Proportion of children 12-15 months of age who were fed breast milk";
- "***Continued breastfeeding at 2 years*****:** Proportion of children 20-23 months of age who were fed breast milk"
- "***Predominant breastfeeding*****:** Proportion of infants 0-5 months of age who were fed with breast milk from the mother (either directly or expressed) and certain liquids (water, water-based drinks and fruit juice), ritual fluids. Infants who received non-human milk and food-based fluids were not included when computing the prevalence of this indicator".

- "***Children ever breastfed*****:** Proportion of children born in the last 24 months who were ever breastfed".

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- **"*Bottle feeding*:** Proportion of children 0-23 months breastfeeding of age who are fed with a bottle"

WHO recommends EBF indicator be disaggregated for the following age groups: 0-1month, 2-3 months, 4-5 months and 0-3 months. Ever breastfed and early initiation of indicators were further disaggregated and reported for live births occurring 0-12, 12-23 and 0-23 months prior to interview. It should be noted that the EBF indicator defined above does not represent the percentage of infants who are exclusively breastfed at their sixth month of age[19, 22] but rather the average prevalence of exclusive breastfeeding of children < 6 months of age.

The breastfeeding indicators were examined by individual level factors, which included mother's age, mother's body mass index (BMI) measured by weight (kg)/height (m^2), mother's literacy, mother's working status, mother's education, mother's marital status, partner's education, partner's occupation, birth order, birth interval, sex of child, age of child, perceived size of the baby, place of delivery, type of delivery assistance, number of antenatal clinic visits, timing of postnatal check-up, mode of delivery, mother's access to mass media; household level factors included household wealth index and mother's autonomy in household decision making; and community level factors included place of residence and geographic zones. The household wealth index was calculated as a score of household assets weighted using the principal components analysis method.[23]

Early initiation of breastfeeding within one hour of birth and exclusive breastfeeding were examined in the multivariate analysis because their prevalence continues to be below the national target and WHO/UNICEF recommendation of 90% coverage.[24, 25] Early initiation of breastfeeding and EBF also play a vital role in protecting infants against diarrhoeal diseases, and reducing mortality among many infants in developing countries.[26] The rates of "ever-breastfed" and "continued breastfeeding" were very high (>90%) hence, they were not included in the multivariate analysis. The indicator for predominant breastfeeding was also included in the multivariate analysis due to its impact on increasing the risk of diarrhoeal and respiratory illness in infants. [26] In addition, bottle feeding was not considered in this analysis because the prevalence was very low (4%).

Data analysis

Our analysis was restricted to the alive, youngest last born infants aged less than 24 months, living with their mothers (women age 15-49 years) during the 2010 TDHS and the total weighted sample was 3,112. The analysis of determinants of early breastfeeding initiation

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was based on the entire sample (3112 children) while those of exclusive breastfeeding and predominant breastfeeding were based on 837 infants aged from 0-5 months. Non-exclusive breastfeeding (non-EBF) was expressed as a dichotomous variable with category 1 for non-EBF and category 0 for EBF. Delayed initiation of breastfeeding was expressed as a dichotomous variable with category 0 for early initiation of breastfeeding and category 1 for delayed initiation of breastfeeding. Predominant breastfeeding was expressed as a dichotomous variable with category 1 for predominant breastfeeding and category 0 for not predominant breastfeeding. These variables were examined against a set of independent variables (individual, household and community characteristics) in order to determine the prevalence and factors associated with delayed initiation of breastfeeding, non-exclusive breastfeeding and predominant breastfeeding indicators.

Analyses were performed using Stata version 10.0 (Stata- Corp, College Station, TX, USA). 'Svy' commands were used to allow for adjustments for the cluster sampling design, sampling weights and the calculation of standard errors. The Taylor series linearization method was used to estimate confidence intervals around prevalence estimates. A chi-squared test was used to test the significance of associations. Unadjusted and adjusted odds ratios (AOR) were calculated to estimate the strength of association between independent variables and three breastfeeding indicator outcomes: delayed initiation of breastfeeding, non-exclusive breastfeeding and predominant breastfeeding. In our multivariate statistical modelling, we created an indicator variable for missing data and restricted our analysis to non-missing data. Multiple logistic regression using surveys commands was conducted using stepwise backwards elimination of variables in order to determine the factors significantly associated with the outcome breastfeeding indicators. The odds ratios with 95% confidence intervals were calculated in order to assess the adjusted risk of independent variables, and only those with $p<0.05$ were retained in the final model. We did our backward stepwise model by adjusting for sampling weights and clusters. We double-checked our background elimination method by using the following procedure: (1) enter only variable with *P*-value <0.20 in our backward elimination process; (2) tested our backward elimination by also including all variables (all potential confounders); and (3) we tested for collinearity. The linear interpolation method was used to compute the median duration of exclusive breastfeeding.

Note: In the present study, delayed initiation of breastfeeding refers to the proportion of children born in the last 24 months who were not put to the breast within one hour of birth

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and non-exclusive breastfeeding refers to the proportion of infants aged 0-5 months who were not fed exclusively with breast milk.

RESULTS

Basic characteristics of the sample

Table 1 shows the distribution of 3,112 children aged less than 24 months according to individual-, household-, and community-level characteristics. The majority of children lived in rural areas (79.7%). Many mothers (67.0%) had primary level education, and about 86% were employed in the last 12 months. Eighty-five per cent of the mothers were currently married, and their husband's occupation was dominated by agricultural activities (63.5%). Of all children, more than half (50.9%) were born in health facilities but a relatively low percentage of mothers delivered by caesarean section (5.1%). Most mothers (48.0%) were assisted by health professionals at delivery, and a high proportion of the mothers were multiparous (80.4%). About 48% of mothers had made at least 3 antenatal clinic visits during pregnancy, and 31.4% had post-natal check-ups by 41 days after birth. The gender of the children was nearly equally represented in the sample. Approximately one quarter (22.6%) of the children was from poor families.

[Insert Table 1].

Breastfeeding indicators

Less than half of the mothers (46.1%) had initiated breastfeeding within the first hour after birth, whereas 98.5% reported they had "ever breastfed" their infants (Table 2). There were 49.9% of the infants less than 6 months of age that were exclusively breastfed, but the median duration for exclusive breastfeeding was only 2.6 months. Less than quarters (16.8%) of the infants below six month of age were predominantly breastfed. About 94% of the children were still breastfed at 12-15 months but the percentage decreased to 51.1% at 20-23 months of age. Few children (3.8%) were bottle-fed from birth to 23 months.

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Table 2: Prevalence of breastfeeding indicators among children aged less than 24 months in Tanzania

Indicator	Size of subsample (weighted)	n (weighted)	Rate (%)	[95% CI]	
Early initiation of breastfeeding 0-23 months	3112	1434	46.1	[43.44,	48.76]
Early initiation of breastfeeding 0-11 months	1630	750	46.0	[42.58,	49.45]
Early initiation of breastfeeding 12-23 months	1482	685	46.2	[43.00,	49.43]
Children ever breastfed 0-23 months	3112	3065	98.5	[97.68,	99.00]
Children ever breastfed 0-11 months	1630	1604	98.4	[97.31,	99.07]
Children ever breastfed 12-23 months	1482	1461	98.6	[97.63,	99.11]
Exclusive breastfeeding 0-5 months	837	418	49.9	[45.65,	54.15]
Exclusive breastfeeding 0-1 month	245	197	80.7	[74.13,	85.94]
Exclusive breastfeeding 2-3 months	299	153	51.1	[44.38,	57.80]
Exclusive breastfeeding 4-5 months	293	67	22.9	[17.69,	29.10]
Exclusive breastfeeding 0-3 months	544	350	64.4	[58.82,	69.66]
Predominant breastfeeding 0-5 months	837	141	16.8	[13.46,	20.74]
Continued breastfeeding at 1 year	524	492	94.0	[91.02,	96.09]
Continued breastfeeding at 2 year	419	214	51.1	[45.19,	57.04]
Bottle feeding 0-23 months	3112	200	3.8	[2.97,	4.97]
Bottle feeding 0-5 months	837	39	4.7	[3.06,	7.17]
Bottle feeding 6-11 months	793	43	5.4	[3.75,	7.73]
Bottle feeding 12-23 months	1482	37	2.5	[1.66,	3.83]

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As shown in Figure 1, prevalence of EBF was more than 86% at birth but declined rapidly with age to 23.1% at 6 months. At birth 10.8% of infants were given breast milk plus other fluids, including water, juices, or other milk.

[Insert Figure 1]

Breastfeeding indicators across individual-, household-, and community-level characteristics

As seen in Table 3, early initiation of breastfeeding within the first hour after birth was significantly lower among mothers who delivered at home (34.0%); those who were not assisted by health professional (32.7%); residing in rural areas (42.2%); those from poorest households (39.3%) and living in the Eastern zone (36.5%) and the Northern zone (39.3%). There was a significantly lower prevalence of early initiation of breastfeeding among mothers who delivered by caesarean section (20.9%); those who did not have any postnatal checkups (42.7%); mothers who did not have any autonomy in decision making (43.1%); mothers who were unable to read (38.9%) and those with poor access to mass media including radio (41.5%) and television (44.1%). In contrast, there was a higher prevalence of early initiation of breastfeeding within one hour of birth among mothers from the richest households (62.9%); from the Central (52.1%), Southern Highland (53.0%) and the Western (51.4%) geographic zones; from urban areas (61.2%); who delivered at health facilities (57.7%); who were married to a husband not involved in agricultural activities (54.9%), and those who had a higher level of education (62.7%) and their partner's had secondary and higher level of education (62.0%).

Exclusive breastfeeding of infants aged less than 6 months of age was significantly lower among mothers who had worked in the last 12 months (48.0%); mothers who resided in urban areas (40.3%); those from the richest households (37.0%) and those living in Zanzibar (10.4%). The proportion of infants who were exclusively breastfed for the first 6 months of life were observed to be higher among mothers from rural areas (52.2%) and those living in the Eastern (52.2%), Western (53.6%) and Southern (51.6%) geographic zones. The rates of predominant breastfeeding were not significantly different across individual-, household- and community-level factors.

[Insert Table 3]

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Determinants of breastfeeding indicators

Unadjusted and adjusted odds ratios were calculated to estimate the effect of the independent variables on three infant feeding outcomes: delayed initiation of breastfeeding within the first hour after birth, non-exclusive breastfeeding and predominant breastfeeding. As seen in Table 4, the adjusted odds of delayed initiation of breastfeeding were significantly higher among infants whose mothers were aged less than 24 years, had a low level of education (no education/primary education), worked in the last 12 months, delivered their babies at home with assistance from untrained provider (traditional birth attendants or relatives/other people) and those who were delivered by caesarean section. The odds of delayed initiation of breastfeeding were also higher for infants from rural compared to infants from urban areas. As compared to infants from the Western geographic zone, infants from Lake, Northern, Eastern and Zanzibar were at higher risk of delayed initiation of breastfeeding within hour after birth.

The odds of non-EBF were significantly higher in infants whose mothers were assisted by traditional birth attendants (TBA) at birth than infants of mothers who were assisted by health professionals. When type of delivery assistant was removed from the final model and replaced by place of delivery, we found that place of delivery was not significantly associated with non-EBF. Hence, type of delivery assistance was retained in the final model. The risk of non-EBF was also significantly higher for urban infants compared to their rural counterparts. As expected, increasing infant age was associated with significantly low rates of EBF. Infants from Zanzibar were at greater risk of non-EBF and predominant breastfeeding compared to infants from other geographic zones

[Insert Table 4]

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DISCUSSION

This study found that less than half of the mothers had initiated breastfeeding within the first hour after birth, and that only half of the mothers exclusively breastfed their infants aged less than 6 months. Seventeen percent of the infants less than 6 months of age were predominately breastfed. We found that lower maternal education, younger maternal age, being employed, delivered at home, delivered by caesarian section, delivery assistance by untrained provider, residing in rural areas of Eastern, Lake, Northern and Zanzibar were determinants of delays in initiation of breastfeeding within first hour after birth. Similarly, delivery assistance by untrained provider and residing in urban areas of Zanzibar were predictors of non-exclusive breastfeeding in the first six months of infant's life. We have also identified the target groups of women who need more breastfeeding support that included young, uneducated, employed women < 25years, women from both rural and urban areas in the Eastern, Lake, Northern and Zanzibar geographic zones, and women who also lacked proper care during and after birth.

This paper is one of the few reports from Africa, including Tanzania, which has described the prevalence of breastfeeding practices using the most recent nationally representative data from Tanzania, and the current WHO recommended definitions for assessing Infant and Young Child Feeding (IYCF) indicators. The findings from this study will help guide health programs to improve early initiation of breastfeeding, and exclusive breastfeeding in order to ensure young children in Tanzania receive the full benefits of appropriate breastfeeding practises including reduced morbidity and mortality.

The main strengths of this study include the use of a large nationally representative survey sample, with very high response rate to the survey interviews (96.4%), comprehensive data on standard infant feeding indicators to identify factors associated with sub-optimal breastfeeding practices in Tanzania, and appropriate sampling design in the analysis. Furthermore, restriction in children sample to only those who lived with their mothers helped ensure greater accuracy of information regarding breastfeeding practices. The main limitation was the cross-sectional nature of the survey which limited inferences about causality from the analyses. In addition, EBF was based on a 24-hour recall rather than a longer recall period, and this short recall may have missed some infants who were fed other liquids or foods prior to the 24 hours before the survey.

The prevalence of early initiation of breastfeeding has declined from 59% in 2005[27] to 46% in 2010 highlighting the need to reverse this trend and to increase the percentage of initiating breastfeeding within one hour of birth. Similarly, the prevalence of EBF in

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Tanzania was very low in comparison with other neighbouring African countries such as Uganda (60%),[28] Zambia (61%)[29] and Malawi (57%).[30] A considerable proportion (17%) of infants less than 6 months was predominantly breastfed, suggesting a need for counselling mothers, caregivers and key family members on the risks associated with predominant feeding. This strategy would help to change their behaviours which ultimately improve EBF. In our analysis we found a significant association between maternal young age (15-24 years) and delayed initiation of breastfeeding. This result is consistent with findings from India which showed that older mothers (≥35 years) were at lower risk of delayed initiation of breastfeeding compared to young mothers (AOR for older mothers ≥ 35 years= 0.72, 95% CI, 0.50 to 1.02).[13] We further explored this association with parity and found that most of the young mothers in Tanzania were first time mothers, suggesting that they lacked knowledge or experience about appropriate breastfeeding practices. Hence the need for health professionals and traditional birth attendants to provide adequate support to encourage the young and first time mothers to establish early initiation of breastfeeding within 1 hour after giving birth.

Similar to findings reported in India,[13] we also found that women with higher levels of education had a reduced risk of delayed initiation of breastfeeding and this might be explained by their exposure to various sources of information and better knowledge about appropriate infant and young child feeding. The variations in the prevalence of early initiation of breastfeeding across different geographic zones could be due to cultural differences and taboos about breastfeeding newborns with first breast milk (i.e. colostrum) in different regions of Tanzania.[31-33]. A major concern is the very low prevalence of EBF in Lake and Zanzibar geographic zones. This could be due to inadequate knowledge among mothers and family members regarding benefits of exclusive breastfeeding in the first six months of infant's life and also existence of belief that breast milk alone is not sufficient to fulfil infant's hunger hence complement with other liquids/soft foods. [31] Provision of adequate support and educating mothers and their families from these zones on the importance of giving the initial breast milk to infants and EBF until 6 months may have a positive effect on improving rates of early initiation of breastfeeding and EBF and potentially reduce the risks of infections and death among newborns.[4].

In this study, rural infants had significantly higher risk of delayed initiation of breastfeeding within 1 hour after birth compared with urban infants. This finding is in agreement with the previous studies from the Morogoro region in Tanzania[31] and from

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Ethiopia.[34] The difference in early initiation of BF between rural and urban mothers might be explained by the high percentage of rural women who delivered at home (93%) assisted by TBAs and other people such as family members. These birth attendants may have had inadequate knowledge of the benefits of this feeding practise and thus failed to support mothers to initiate breastfeeding early. Furthermore, negative cultural beliefs about colostrum and lower level of education among rural mothers (88%) might also have contributed. Rural women may need more support to overcome the barriers to early initiation of especially those living in the Eastern, Lake, Northern and Zanzibar geographic zones. On the other hand, mothers from urban areas were at greater risk of poor EBF practices than mothers from rural areas, possibly because of the demand to return to work after maternity leave [11] since most of these urban mothers were in paid employment. Also most mothers in urban areas were from families with higher socioeconomic status compared to rural areas and that may have facilitated access to breast milk substitutes. For example, data from a multilevel analysis of factors associated with non-EBF in nine East and Southeast Asian countries revealed that improved socioeconomic status both at individual and community levels was a negative factor for EBF.[9]

The risk of delayed initiation of breastfeeding in the first hour after birth was significantly higher among mothers who delivered at home compared to those who delivered at health facilities. Likewise, having a baby not delivered by health professional was a significant predictor of non-EBF. This indicates the need to educate key family members and TBAs about the benefits of initial breast milk for the newborn so that they can encourage mothers who deliver at home to establish breast-feeding immediately after birth and EBF up to 6 months. Exclusive breastfeeding should also be promoted at health facilities during antenatal care visits and during deliveries; and at the community level through peer counselling support for EBF. [35]

Delivery by caesarean section was a risk factor for delayed initiation of breastfeeding in Tanzania. This finding is consistent with previous reports from India,[13] Nepal[36] and Sri-Lanka.[37] This association may be linked to the effects of anaesthesia delaying the onset of lactation and some baby unfriendly post operative care practices.[38] A recent systematic review and meta-analysis of observational studies that examined influence of caesarean delivered on early breastfeeding showed that caesarean delivery has a significant adverse association with early breastfeeding.[17] Appropriate guidelines for caesarean deliveries are needed to minimize delays in initiation of breastfeeding. Prospective mothers and health

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workers should be informed about the negative association between pre-labor caesarean delivery and breastfeeding and the implications for infant well-being. [17]

Our analysis showed a negative association between maternal working status and early initiation of breastfeeding 1 hour after birth. However, our sub-analysis to examine the relationship between maternal working status and area of residence found that, most working mothers (68.6%) resided in the rural areas than in urban areas (12.5%) and they had higher risk of delayed initiation of breastfeeding within 1 hour after birth as discussed earlier. We also found that the prevalence of EBF decreased with increasing age of the child. This finding was in conformity with other secondary analyses of Demographic and Health Surveys conducted in Nigeria,[18] India,[13] Bangladesh,[39] Sri-Lanka, Cambodia, Indonesia, Philippines and Timor-Leste, and Vietnam[9] and Malawi[14] which have also reported a declining prevalence of EBF as the age of the child increased.

CONCLUSIONS

The prevalence of breastfeeding indicators regarding early initiation of breastfeeding and EBF were below the national targets (90% coverage)[40] and improvement is needed in order for infants to gain the full benefits of breastfeeding and help the country achieve the Millennium Development Goal for reduction of infant mortality from 51 deaths per 1,000 births in 2010 to 38 deaths per 1,000 live births by the year 2015[2]. The improvement of breastfeeding practices will require national level programs and with a focus on the target groups with sub-optimal breastfeeding practices including young, uneducated mothers who deliver at home assisted by untrained health personnel, and those who deliver by caesarean section. Further research is recommended to investigate why early initiation of breastfeeding is decreasing in Tanzania.

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Appendices

Table 1: Individual, household and community level characteristics for children 0-23 months of age, Tanzania 2010

Table 3: Rates of early initiation of breastfeeding, exclusive breastfeeding and predominant breastfeeding by individual, household and community level characteristics, Tanzania 2010.

Table 4: Unadjusted and adjusted Odds Ratio (OR) for delayed initiation of breastfeeding, non-exclusive breastfeeding and predominant breastfeeding in Tanzania 2010

Table 5: Response to reviewer's comments

Figure 1: Distribution of children by breastfeeding status according to age.

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Determinants of breastfeeding indicators among children less than 24 months of age in Tanzania: a secondary analysis of 2010 Tanzania Demographic and Health Survey

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Article summary

Article focus

- This paper aims to examine key World Health Organization (WHO) breastfeeding indicators in Tanzania and determine factors associated with delayed initiation of breastfeeding, non-exclusive breastfeeding and predominant breastfeeding practices in children aged 0-23 months.

Key messages

- Prevalence of early initiation and exclusive breastfeeding indicators fell below national targets for Tanzania. A considerable proportion of infants less than 6 months were predominantly breastfed.
- Children who live in the Northern, Southern zones and Zanzibar were at higher risk of sub-optimal breastfeeding practices than children in other geographic zones of Tanzania.
- Young maternal age, lower maternal education, employment, home delivery and lack of professional assistance at birth were the main determinants of sub-optimal breastfeeding practices in Tanzania.

Comment [s1]: R2C1&2

Strengths and limitations of the study

- The main limitation was the cross-sectional nature of the survey, which limited inferences about causality from the analyses.
- In addition, exclusive breastfeeding was based on a 24-hour recall rather than a longer recall period, and this short recall may have missed some infants who were fed other liquids or foods prior to the 24 hours before the survey.
- However, the use of a large nationally representative survey sample with very high response rate (96.4%), the appropriate statistical adjustments for survey design and modelling for confounding effects add strength to the validity of the findings. Furthermore, restricting the sample to only children less than 2 years who lived with their mothers helped ensure greater accuracy of information regarding breastfeeding practices.

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Abstract

Objective: To examine the prevalence of key World Health Organization (WHO) breastfeeding indicators and identify determinants of suboptimal breastfeeding practices among children aged less than 24 months in Tanzania.

Design, setting and participants: Secondary analyses of cross-sectional data from the 2010 Tanzania Demographic and Health Survey (TDHS). The survey used a stratified two-stage cluster sample of 10,312 households from eight geographic zones of Tanzania. The sample consisted of 3,112 children aged 0-23 months.

Main outcome measures: Outcome measures were factors significantly associated with delayed initiation of breastfeeding, non-exclusive breastfeeding and predominant breastfeeding in the first six months.

Results: Breastfeeding was initiated within the first hour of birth in 46.1% of mothers. In infants aged less than six months the prevalence of exclusive breastfeeding was 49.9% but only 22.9% were exclusively breastfed at 4-5 months. Seventeen per cent of infants less than 6 months were "predominantly breastfed". At 12-15 months, 94.0% of infants were still breastfed but the proportion decreased to 51.1% at 20-23 months of age. Multivariate analysis revealed that the risk of delayed initiation of breastfeeding within one hour after birth was significantly higher among young mothers aged <24 years, uneducated and employed mothers from rural areas who delivered by caesarean section and those who delivered at home and were assisted by traditional birth attendants or relatives. The risk factors associated with non-exclusive breastfeeding during the first six months were lack of professional assistance at birth and residence in urban areas. The risk of predominant breastfeeding was significantly higher among infants from Zanzibar geographic zone

Conclusions: Early initiation of breastfeeding and exclusive breastfeeding indicators were unsatisfactory and are below the national targets for Tanzania. To improve breastfeeding practices will require national level programs but with a focus on the target groups with sub-optimal breastfeeding practices.

Comment [s2]: R2C3

Comment [s3]: R1C3

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INTRODUCTION

The World Health Organization (WHO)[1] infant feeding guidelines recommend that all infants should be breastfed within 1 hour after birth and exclusively breastfed from birth until 6 months of life. Thereafter infants should be introduced to nutritionally adequate and safe complementary foods with continued breastfeeding for up to two years or beyond. In line with WHO recommendations, Tanzania has been implementing a number of initiatives to improve infant feeding practices, which include the National Strategy and Implementation Plan on Infant and Young Child Nutrition, the Baby Friendly Hospital Initiatives (BFHI) and the training of health workers on infant feeding skills. Despite these efforts, breastfeeding practices and especially the early initiation and exclusive breastfeeding remain suboptimal in Tanzania.[2]

According to the Tanzania Demographic and Health Survey (TDHS) of 2010,[2] breastfeeding was almost universal at 99% in all socio-demographic categories, however, early initiation of breastfeeding within one hour after birth was reported by 46.1% of women who recently delivered a baby, while the prevalence of exclusive breastfeeding (EBF) was 50% among infants less than six months.[2] This implies that a considerable proportion of infants aged less than 6 months are introduced to other liquids and solid foods before the recommended age of 6 months and thereby limiting the full benefits of breastfeeding. Low adherence to optimal breastfeeding including exclusive breast feeding for the first 6 month and risk of diarrheal disease from contaminated complementary foods given to infants well before 6 months of age is believed to contribute to under nutrition observed in young children. For instance, the 2010 TDHS reported that 35% of children under-five years of age were stunted while 21% were under weight indicating that undernutrition is a public health problem in Tanzania that needs to be addressed at a very early stage of infant's life.[2]

It is well established that optimal breastfeeding confers protective effects against gastrointestinal infections and improves child survival.[3-5] A cohort study carried out in Ghana revealed that 22% of neonatal deaths could be prevented if all infants were put to the breast within the first hour of birth.[4] It has also been reported that exclusive breastfeeding from birth and until 6 months of age has the potential to prevent 13% of all deaths among children aged less than 5 years annually in developing countries.[6]

Research investigating the factors associated with suboptimal breastfeeding practices has been conducted in developed and developing countries, including Africa, and shows that

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delayed initiation of breastfeeding after birth and not exclusive breastfeeding during the first 6 months were influenced by factors such as maternal age,[7-9] maternal level of education,[8-10] maternal employment status,[10, 11] maternal nutritional status,[12] place of delivery,[13, 14] mode of delivery,[15-17] area of residence,[16] household wealth status[10] and geographical differences.[16, 18] These factors have been documented to be either positively or negatively associated with breastfeeding practices and the inconsistencies of the results found in different countries make it difficult to generalize the findings to all countries, hence the need to identify factors that are associated with breastfeeding practices in Tanzania.

This secondary data analysis of the 2010 TDHS aims to describe the prevalence of breastfeeding practices using the current WHO breastfeeding indicators,[19] and to determine the factors associated with delayed initiation of breastfeeding, non-exclusive breastfeeding and predominant breastfeeding among children less than 24 months of age in Tanzania.

METHODS

Data source

The present analysis was based on the 2010 Tanzania Demographic and Health Survey (TDHS),[2] which was conducted from December 2009 to May 2010 by the National Bureau of Statistics and the Office of the Chief Government Statistician –Zanzibar in collaboration with the Ministry of Health and Social Welfare. The 2010 TDHS is the eighth in a series of Demographic and Health Surveys conducted in Tanzania. The survey aimed to gather information about child mortality, nutrition, maternal and child health, as well as family planning and other reproductive health issues. The survey sample was designed to provide estimates for the entire country, for both urban and rural areas which comprised of 26 regions from Tanzania mainland and Zanzibar.

Survey design

The 2010 TDHS utilised a cross-sectional study design and the nationally representative survey sample was obtained using stratified two-stage random sampling.[2] In the first stage, 475 clusters were selected from a list of enumeration areas from the 2002 Population and Housing Census.[20] Eighteen clusters were selected in each region except Dar es Salaam, where 25 clusters were selected in the Mainland. In Zanzibar, 18 clusters were selected in each region for a total of 90 sample points. In the second stage, a complete household listing

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was carried out in each of the selected clusters. Twenty-two households were selected from each cluster in all regions except for Dar es Salaam where 16 households were systematically selected. A total of 10,300 households were selected for the sample, of which 10,176 were successfully interviewed, yielding a household response rate of 99%. From these households, 10,522 women of reproductive age (15-49 years) who were either permanent residents of the households in the 2010 TDHS sample or visitors present in the household on the night before the survey were interviewed. Face-to-face interviews were held with the sampled mothers using a structured questionnaire yielding an interview response rate of 96.4%. Comprehensive details regarding the sampling procedure and data collection tools are available in the 2010 TDHS report.[2]

Feeding indicators

There are fifteen indicators recommended by WHO [19, 21] for assessing infant and young child feeding practices. The breastfeeding indicators reported in the survey include:-

Comment [s4]: R3C2

- "***Early initiation of breastfeeding*****:** Proportion of children born in the last 24 months who were put to the breast within one hour of birth-this indicator based on historical recall";
- "***Exclusive breastfeeding under 6 months*****:** Proportion of infants 0-5 months of age who were fed exclusively with breast milk -this indicator is based on mother's recall on feeds given to the infant in the previous day";
- "***Continued breastfeeding at 1 year*****:** Proportion of children 12-15 months of age who were fed breast milk";
- "***Continued breastfeeding at 2 years*****:** Proportion of children 20-23 months of age who were fed breast milk"
- "***Predominant breastfeeding*****:** Proportion of infants 0-5 months of age who were fed with breast milk from the mother (either directly or expressed) and certain liquids (water, water-based drinks and fruit juice), ritual fluids. Infants who received non-human milk and food-based fluids were not included when computing the prevalence of this indicator".

- "***Children ever breastfed*****:** Proportion of children born in the last 24 months who were ever breastfed".

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- **"*Bottle feeding*:** Proportion of children 0-23 months breastfeeding of age who are fed with a bottle"

Comment [s5]: R3C3

WHO recommends EBF indicator be disaggregated for the following age groups: 0-1month, 2-3 months, 4-5 months and 0-3 months. Ever breastfed and early initiation of indicators were further disaggregated and reported for live births occurring 0-12, 12-23 and 0-23 months prior to interview. It should be noted that the EBF indicator defined above does not represent the percentage of infants who are exclusively breastfed at their sixth month of age[19, 22] but rather the average prevalence of exclusive breastfeeding of children < 6 months of age.

The breastfeeding indicators were examined by individual level factors, which included mother's age, mother's body mass index (BMI) measured by weight (kg)/height (m^2), mother's literacy, mother's working status, mother's education, mother's marital status, partner's education, partner's occupation, birth order, birth interval, sex of child, age of child, perceived size of the baby, place of delivery, type of delivery assistance, number of antenatal clinic visits, timing of postnatal check-up, mode of delivery, mother's access to mass media; household level factors included household wealth index and mother's autonomy in household decision making; and community level factors included place of residence and geographic zones. The household wealth index was calculated as a score of household assets weighted using the principal components analysis method.[23]

Comment [s6]: R1C2

Early initiation of breastfeeding within one hour of birth and exclusive breastfeeding were examined in the multivariate analysis because their prevalence continues to be below the national target and WHO/UNICEF recommendation of 90% coverage.[24, 25] Early initiation of breastfeeding and EBF also play a vital role in protecting infants against diarrhoeal diseases, and reducing mortality among many infants in developing countries.[26] The rates of "ever-breastfed" and "continued breastfeeding" were very high (>90%) hence, they were not included in the multivariate analysis. The indicator for predominant breastfeeding was also included in the multivariate analysis due to its impact on increasing the risk of diarrhoeal and respiratory illness in infants. [26] In addition, bottle feeding was not considered in this analysis because the prevalence was very low (4%).

Comment [s7]: R3C2

Data analysis

Our analysis was restricted to the alive, youngest last born infants aged less than 24 months, living with their mothers (women age 15-49 years) during the 2010 TDHS and the total weighted sample was 3,112. The analysis of determinants of early breastfeeding initiation

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was based on the entire sample (3112 children) while those of exclusive breastfeeding and predominant breastfeeding were based on 837 infants aged from 0-5 months. Non-exclusive breastfeeding (non-EBF) was expressed as a dichotomous variable with category 1 for non-EBF and category 0 for EBF. Delayed initiation of breastfeeding was expressed as a dichotomous variable with category 0 for early initiation of breastfeeding and category 1 for delayed initiation of breastfeeding. Predominant breastfeeding was expressed as a dichotomous variable with category 1 for predominant breastfeeding and category 0 for not predominant breastfeeding. These variables were examined against a set of independent variables (individual, household and community characteristics) in order to determine the prevalence and factors associated with delayed initiation of breastfeeding, non-exclusive breastfeeding and predominant breastfeeding indicators.

Comment [s8]: R2C4

Comment [s9]: R3C7

Analyses were performed using Stata version 10.0 (Stata- Corp, College Station, TX, USA). 'Svy' commands were used to allow for adjustments for the cluster sampling design, sampling weights and the calculation of standard errors. The Taylor series linearization method was used to estimate confidence intervals around prevalence estimates. A chi-squared test was used to test the significance of associations. Unadjusted and adjusted odds ratios (AOR) were calculated to estimate the strength of association between independent variables and three breastfeeding indicator outcomes: delayed initiation of breastfeeding, non-exclusive breastfeeding and predominant breastfeeding. In our multivariate statistical modelling, we created an indicator variable for missing data and restricted our analysis to non-missing data. Multiple logistic regression using surveys commands was conducted using stepwise backwards elimination of variables in order to determine the factors significantly associated with the outcome breastfeeding indicators. The odds ratios with 95% confidence intervals were calculated in order to assess the adjusted risk of independent variables, and only those with $p<0.05$ were retained in the final model. We did our backward stepwise model by adjusting for sampling weights and clusters. We double-checked our background elimination method by using the following procedure: (1) enter only variable with *P*-value <0.20 in our backward elimination process; (2) tested our backward elimination by also including all variables (all potential confounders); and (3) we tested for collinearity. The linear interpolation method was used to compute the median duration of exclusive breastfeeding.

Note: In the present study, delayed initiation of breastfeeding refers to the proportion of children born in the last 24 months who were not put to the breast within one hour of birth

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and non-exclusive breastfeeding refers to the proportion of infants aged 0-5 months who were not fed exclusively with breast milk.

Comment [s10]: R3C1

RESULTS

Basic characteristics of the sample

Table 1 shows the distribution of 3,112 children aged less than 24 months according to individual-, household-, and community-level characteristics. The majority of children lived in rural areas (79.7%). Many mothers (67.0%) had primary level education, and about 86% were employed in the last 12 months. Eighty-five per cent of the mothers were currently married, and their husband's occupation was dominated by agricultural activities (63.5%). Of all children, more than half (50.9%) were born in health facilities but a relatively low percentage of mothers delivered by caesarean section (5.1%). Most mothers (48.0%) were assisted by health professionals at delivery, and a high proportion of the mothers were multiparous (80.4%). About 48% of mothers had made at least 3 antenatal clinic visits during pregnancy, and 31.4% had post-natal check-ups by 41 days after birth. The gender of the children was nearly equally represented in the sample. Approximately one quarter (22.6%) of the children was from poor families.

[Insert Table 1].

Breastfeeding indicators

Less than half of the mothers (46.1%) had initiated breastfeeding within the first hour after birth, whereas 98.5% reported they had "ever breastfed" their infants (Table 2). There were 49.9% of the infants less than 6 months of age that were exclusively breastfed, but the median duration for exclusive breastfeeding was only 2.6 months. Less than quarters (16.8%) of the infants below six month of age were predominantly breastfed. About 94% of the children were still breastfed at 12-15 months but the percentage decreased to 51.1% at 20-23 months of age. Few children (3.8%) were bottle-fed from birth to 23 months.

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Table 2: Prevalence of breastfeeding indicators among children aged less than 24 months in Tanzania

Indicator	Size of subsample (weighted)	n (weighted)	Rate (%)	[95% CI]	
Early initiation of breastfeeding 0-23 months	3112	1434	46.1	[43.44,	48.76]
Early initiation of breastfeeding 0-11 months	1630	750	46.0	[42.58,	49.45]
Early initiation of breastfeeding 12-23 months	1482	685	46.2	[43.00,	49.43]
Children ever breastfed 0-23 months	3112	3065	98.5	[97.68,	99.00]
Children ever breastfed 0-11 months	1630	1604	98.4	[97.31,	99.07]
Children ever breastfed 12-23 months	1482	1461	98.6	[97.63,	99.11]
Exclusive breastfeeding 0-5 months	837	418	49.9	[45.65,	54.15]
Exclusive breastfeeding 0-1 month	245	197	80.7	[74.13,	85.94]
Exclusive breastfeeding 2-3 months	299	153	51.1	[44.38,	57.80]
Exclusive breastfeeding 4-5 months	293	67	22.9	[17.69,	29.10]
Exclusive breastfeeding 0-3 months	544	350	64.4	[58.82,	69.66]
Predominant breastfeeding 0-5 months	837	141	16.8	[13.46,	20.74]
Continued breastfeeding at 1 year	524	492	94.0	[91.02,	96.09]
Continued breastfeeding at 2 year	419	214	51.1	[45.19,	57.04]
Bottle feeding 0-23 months	3112	200	3.8	[2.97,	4.97]
Bottle feeding 0-5 months	837	39	4.7	[3.06,	7.17]
Bottle feeding 6-11 months	793	43	5.4	[3.75,	7.73]
Bottle feeding 12-23 months	1482	37	2.5	[1.66,	3.83]

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As shown in Figure 1, prevalence of EBF was more than 86% at birth but declined rapidly with age to 23.1% at 6 months. At birth 10.8% of infants were given breast milk plus other fluids, including water, juices, or other milk.

[Insert Figure 1]

Breastfeeding indicators across individual-, household-, and community-level characteristics

As seen in Table 3, early initiation of breastfeeding within the first hour after birth was significantly lower among mothers who delivered at home (34.0%); those who were not assisted by health professional (32.7%); residing in rural areas (42.2%); those from poorest households (39.3%) and living in the Eastern zone (36.5%) and the Northern zone (39.3%). There was a significantly lower prevalence of early initiation of breastfeeding among mothers who delivered by caesarean section (20.9%); those who did not have any postnatal checkups (42.7%); mothers who did not have any autonomy in decision making (43.1%); mothers who were unable to read (38.9%) and those with poor access to mass media including radio (41.5%) and television (44.1%). In contrast, there was a higher prevalence of early initiation of breastfeeding within one hour of birth among mothers from the richest households (62.9%); from the Central (52.1%), Southern Highland (53.0%) and the Western (51.4%) geographic zones; from urban areas (61.2%); who delivered at health facilities (57.7%); who were married to a husband not involved in agricultural activities (54.9%), and those who had a higher level of education (62.7%) and their partner's had secondary and higher level of education (62.0%).

Comment [s11]: R1C4

Comment [s12]: R1C6

Exclusive breastfeeding of infants aged less than 6 months of age was significantly lower among mothers who had worked in the last 12 months (48.0%); mothers who resided in urban areas (40.3%); those from the richest households (37.0%) and those living in Zanzibar (10.4%). The proportion of infants who were exclusively breastfed for the first 6 months of life were observed to be higher among mothers from rural areas (52.2%) and those living in the Eastern (52.2%), Western (53.6%) and Southern (51.6%) geographic zones. The rates of predominant breastfeeding were not significantly different across individual-, household- and community-level factors.

[Insert Table 3]

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Determinants of breastfeeding indicators

Unadjusted and adjusted odds ratios were calculated to estimate the effect of the independent variables on three infant feeding outcomes: delayed initiation of breastfeeding within the first hour after birth, non-exclusive breastfeeding and predominant breastfeeding. As seen in Table 4, the adjusted odds of delayed initiation of breastfeeding were significantly higher among infants whose mothers were aged less than 24 years, had a low level of education (no education/primary education), worked in the last 12 months, delivered their babies at home with assistance from untrained provider (traditional birth attendants or relatives/other people) and those who were delivered by caesarean section. The odds of delayed initiation of breastfeeding were also higher for infants from rural compared to infants from urban areas. As compared to infants from the Western geographic zone, infants from Lake, Northern, Eastern and Zanzibar were at higher risk of delayed initiation of breastfeeding within hour after birth.

The odds of non-EBF were significantly higher in infants whose mothers were assisted by traditional birth attendants (TBA) at birth than infants of mothers who were assisted by health professionals. When type of delivery assistant was removed from the final model and replaced by place of delivery, we found that place of delivery was not significantly associated with non-EBF. Hence, type of delivery assistance was retained in the final model. The risk of non-EBF was also significantly higher for urban infants compared to their rural counterparts. As expected, increasing infant age was associated with significantly low rates of EBF. Infants from Zanzibar were at greater risk of non-EBF and predominant breastfeeding compared to infants from other geographic zones

[Insert Table 4]

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DISCUSSION

This study found that less than half of the mothers had initiated breastfeeding within the first hour after birth, and that only half of the mothers exclusively breastfed their infants aged less than 6 months. Seventeen percent of the infants less than 6 months of age were predominately breastfed. We found that lower maternal education, younger maternal age, being employed, delivered at home, delivered by caesarian section, delivery assistance by untrained provider, residing in rural areas of Eastern, Lake, Northern and Zanzibar were determinants of delays in initiation of breastfeeding within first hour after birth. Similarly, delivery assistance by untrained provider and residing in urban areas of Zanzibar were predictors of non-exclusive breastfeeding in the first six months of infant's life. We have also identified the target groups of women who need more breastfeeding support that included young, uneducated, employed women < 25years, women from both rural and urban areas in the Eastern, Lake, Northern and Zanzibar geographic zones, and women who also lacked proper care during and after birth.

This paper is one of the few reports from Africa, including Tanzania, which has described the prevalence of breastfeeding practices using the most recent nationally representative data from Tanzania, and the current WHO recommended definitions for assessing Infant and Young Child Feeding (IYCF) indicators. The findings from this study will help guide health programs to improve early initiation of breastfeeding, and exclusive breastfeeding in order to ensure young children in Tanzania receive the full benefits of appropriate breastfeeding practises including reduced morbidity and mortality.

Comment [s13]: R2C5

The main strengths of this study include the use of a large nationally representative survey sample, with very high response rate to the survey interviews (96.4%), comprehensive data on standard infant feeding indicators to identify factors associated with sub-optimal breastfeeding practices in Tanzania, and appropriate sampling design in the analysis. Furthermore, restriction in children sample to only those who lived with their mothers helped ensure greater accuracy of information regarding breastfeeding practices. The main limitation was the cross-sectional nature of the survey which limited inferences about causality from the analyses. In addition, EBF was based on a 24-hour recall rather than a longer recall period, and this short recall may have missed some infants who were fed other liquids or foods prior to the 24 hours before the survey.

The prevalence of early initiation of breastfeeding has declined from 59% in 2005[27] to 46% in 2010 highlighting the need to reverse this trend and to increase the percentage of initiating breastfeeding within one hour of birth. Similarly, the prevalence of EBF in

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Tanzania was very low in comparison with other neighbouring African countries such as Uganda (60%),[28] Zambia (61%)[29] and Malawi (57%).[30] A considerable proportion (17%) of infants less than 6 months was predominantly breastfed, suggesting a need for counselling mothers, caregivers and key family members on the risks associated with predominant feeding. This strategy would help to change their behaviours which ultimately improve EBF. In our analysis we found a significant association between maternal young age (15-24 years) and delayed initiation of breastfeeding. This result is consistent with findings from India which showed that older mothers (≥35 years) were at lower risk of delayed initiation of breastfeeding compared to young mothers (AOR for older mothers ≥ 35 years= 0.72, 95% CI, 0.50 to 1.02).[13] We further explored this association with parity and found that most of the young mothers in Tanzania were first time mothers, suggesting that they lacked knowledge or experience about appropriate breastfeeding practices. Hence the need for health professionals and traditional birth attendants to provide adequate support to encourage the young and first time mothers to establish early initiation of breastfeeding within 1 hour after giving birth.

Similar to findings reported in India,[13] we also found that women with higher levels of education had a reduced risk of delayed initiation of breastfeeding and this might be explained by their exposure to various sources of information and better knowledge about appropriate infant and young child feeding. The variations in the prevalence of early initiation of breastfeeding across different geographic zones could be due to cultural differences and taboos about breastfeeding newborns with first breast milk (i.e. colostrum) in different regions of Tanzania.[31-33]. A major concern is the very low prevalence of EBF in Lake and Zanzibar geographic zones. This could be due to inadequate knowledge among mothers and family members regarding benefits of exclusive breastfeeding in the first six months of infant's life and also existence of belief that breast milk alone is not sufficient to fulfil infant's hunger hence complement with other liquids/soft foods. [31] Provision of adequate support and educating mothers and their families from these zones on the importance of giving the initial breast milk to infants and EBF until 6 months may have a positive effect on improving rates of early initiation of breastfeeding and EBF and potentially reduce the risks of infections and death among newborns.[4].

Comment [s14]: R1C7

In this study, rural infants had significantly higher risk of delayed initiation of breastfeeding within 1 hour after birth compared with urban infants. This finding is in agreement with the previous studies from the Morogoro region in Tanzania[31] and from

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Ethiopia.[34] The difference in early initiation of BF between rural and urban mothers might be explained by the high percentage of rural women who delivered at home (93%) assisted by TBAs and other people such as family members. These birth attendants may have had inadequate knowledge of the benefits of this feeding practise and thus failed to support mothers to initiate breastfeeding early. Furthermore, negative cultural beliefs about colostrum and lower level of education among rural mothers (88%) might also have contributed. Rural women may need more support to overcome the barriers to early initiation of especially those living in the Eastern, Lake, Northern and Zanzibar geographic zones. On the other hand, mothers from urban areas were at greater risk of poor EBF practices than mothers from rural areas, possibly because of the demand to return to work after maternity leave [11] since most of these urban mothers were in paid employment. Also most mothers in urban areas were from families with higher socioeconomic status compared to rural areas and that may have facilitated access to breast milk substitutes. For example, data from a multilevel analysis of factors associated with non-EBF in nine East and Southeast Asian countries revealed that improved socioeconomic status both at individual and community levels was a negative factor for EBF.[9]

The risk of delayed initiation of breastfeeding in the first hour after birth was significantly higher among mothers who delivered at home compared to those who delivered at health facilities. Likewise, having a baby not delivered by health professional was a significant predictor of non-EBF. This indicates the need to educate key family members and TBAs about the benefits of initial breast milk for the newborn so that they can encourage mothers who deliver at home to establish breast-feeding immediately after birth and EBF up to 6 months. Exclusive breastfeeding should also be promoted at health facilities during antenatal care visits and during deliveries; and at the community level through peer counselling support for EBF. [35]

Delivery by caesarean section was a risk factor for delayed initiation of breastfeeding in Tanzania. This finding is consistent with previous reports from India,[13] Nepal[36] and Sri-Lanka.[37] This association may be linked to the effects of anaesthesia delaying the onset of lactation and some baby unfriendly post operative care practices.[38] A recent systematic review and meta-analysis of observational studies that examined influence of caesarean delivered on early breastfeeding showed that caesarean delivery has a significant adverse association with early breastfeeding.[17] Appropriate guidelines for caesarean deliveries are needed to minimize delays in initiation of breastfeeding. Prospective mothers and health

Comment [s15]: R1C5

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workers should be informed about the negative association between pre-labor caesarean delivery and breastfeeding and the implications for infant well-being. [17]

Our analysis showed a negative association between maternal working status and early initiation of breastfeeding 1 hour after birth. However, our sub-analysis to examine the relationship between maternal working status and area of residence found that, most working mothers (68.6%) resided in the rural areas than in urban areas (12.5%) and they had higher risk of delayed initiation of breastfeeding within 1 hour after birth as discussed earlier. We also found that the prevalence of EBF decreased with increasing age of the child. This finding was in conformity with other secondary analyses of Demographic and Health Surveys conducted in Nigeria,[18] India,[13] Bangladesh,[39] Sri-Lanka, Cambodia, Indonesia, Philippines and Timor-Leste, and Vietnam[9] and Malawi[14] which have also reported a declining prevalence of EBF as the age of the child increased.

CONCLUSIONS

The prevalence of breastfeeding indicators regarding early initiation of breastfeeding and EBF were below the national targets (90% coverage)[40] and improvement is needed in order for infants to gain the full benefits of breastfeeding and help the country achieve the Millennium Development Goal for reduction of infant mortality from 51 deaths per 1,000 births in 2010 to 38 deaths per 1,000 live births by the year 2015[2]. The improvement of breastfeeding practices will require national level programs and with a focus on the target groups with sub-optimal breastfeeding practices including young, uneducated mothers who deliver at home assisted by untrained health personnel, and those who deliver by caesarean section. Further research is recommended to investigate why early initiation of breastfeeding is decreasing in Tanzania.

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Authors' contributions: RV designed the study, performed the analysis, and prepared the manuscript; SKB provided advice on study design, and critically revised the manuscript for intellectual content; KEA provided advice on study design, data-analysis and critically revised the manuscript for intellectual content; and MJD provided advice on study design and critically revised the manuscript for intellectual content.

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Data sharing statement: Appendices to the extended report are available in English.

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Appendices

Table 1: Individual, household and community level characteristics for children 0-23 months of age, Tanzania 2010

Table 3: Rates of early initiation of breastfeeding, exclusive breastfeeding and predominant breastfeeding by individual, household and community level characteristics, Tanzania 2010.

Table 4: Unadjusted and adjusted Odds Ratio (OR) for delayed initiation of breastfeeding, non-exclusive breastfeeding and predominant breastfeeding in Tanzania 2010

Table 5: Response to reviewer's comments

Figure 1: Distribution of children by breastfeeding status according to age.

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Checklist of items included in this *cross-sectional study*.

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2 & 3
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4 & 5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5 & 6
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	6 & 7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6 & 8
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7
Bias	9	Describe any efforts to address potential sources of bias	*13*
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7 & 8
		(*b*) Describe any methods used to examine subgroups and interactions	8
		(*c*) Explain how missing data were addressed	8
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	8
		(*e*) Describe any sensitivity analyses	8
Results			

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Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	7
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9
		(b) Indicate number of participants with missing data for each variable of interest	8
Outcome data	15*	Report numbers of outcome events or summary measures	9
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	11 & 12
		(*b*) Report category boundaries when continuous variables were categorized	8
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	16
Discussion			
Key results	18	Summarise key results with reference to study objectives	13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14-16
Generalisability	21	Discuss the generalisability (external validity) of the study results	16
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	17

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Table 1: Individual, household and community level characteristics for children 0-23 months of age, Tanzania 2010 (n=3112)

Characteristic	n	%
Individual level factors		
Maternal working status		
Non-working	448	14.4
Working (past 12 mo)	2664	85.6
Maternal education		
No education	799	25.7
Primary	2084	67.0
Secondary and above	229	7.4
Partner's occupation		
Non agriculture	907	29.1
Agriculture	1977	63.5
Not working	229	7.3
Partner's education (n=2889)		
No education	534	18.5
Primary	2079	72.0
Secondary and above	276	9.5
Mother's age		
15-19years	1160	37.3
20-34years	1342	43.1
35-49years	611	19.6
Marital status		
Currently married	2637	84.7
Formerly married (div/sep/widow)	263	8.4
Never married	213	6.8
Birth order		
First-born	611	19.6
2nd-4th	1518	48.8
5 or more	983	31.6
Preceding birth interval (n=3106)		
No previous birth	611	19.7
<24 months	358	11.5
>24 months	2137	68.8
Sex of baby		
Male	1539	49.5
Female	1573	50.6
Child's age in months		
0-5 months	837	26.9
6-11 months	793	25.5
12-17 months	772	24.8
18-23 months	710	22.8
Place of delivery		
Home	1528	49.1

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Health facility	584	50.9
Mode of delivery (n=3107)		
Non-caesarean	2949	94.9
Caesarean section	158	5.1
Type of delivery assistance (n=3105)		
Health professional	1487	47.9
Traditional birth attendant.	388	12.5
Relatives or untrained people	1229	39.6
Antenatal Clinic visits (n=3104)		
None	65	2.1
1-3 visits	1839	59.2
4+ visits	1201	38.7
Timing of postnatal check-up (n=3058)		
No check-ups (including missing)	2097	68.6
0-2 days	466	15.2
3-6 days	176	5.8
7+ days	319	10.4
Mother's BMI(kg/m^2)		
<=18.5	303	9.7
>18.5 - <=24.9	2277	73.2
>24.9 - <=29.9	397	12.8
>=30	135	4.3
Mother's literacy(n=3084)		
Can't read	1273	41.3
Can read	1812	58.7
Mother's frequency of reading newspaper (n=3109)		
Not at all	2702	86.9
Yes	407	13.1
Mother's frequency of listening to radio (n=3109)		
Not at all	1509	48.6
Yes	1600	51.5
Mother's frequency of watching TV		
Not at all	2669	85.8
Yes	443	14.2
Household level factors		
Wealth Index		
Poorest (lowest quintile)	656	21.1
Poorer	751	24.1
Middle	675	21.7
Richer	581	18.7
Richest (highest quintile)	450	14.5
Decisions women have final say		
None	1383	44.4
One-two	577	18.5
Three-four	459	14.8
Five and more	693	22.3

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Community level factors		
Residence		
Urban	631	20.3
Rural	2481	79.7
Geographical Zone		
Northern	451	14.5
Eastern	514	16.5
Western	496	15.9
Southern Highlands	346	11.1
Lake	405	13.0
Southern	222	7.1
Central	594	19.1
Zanzibar	84	2.7
Total	**3112**	**100.0**

Weighted total was 3112 otherwise stated within brackets.

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Table 3 Rates of early initiation of breastfeeding, exclusive breastfeeding and predominant breastfeeding by individual, household and community level characteristics, Tanzania 2010.

	Early initiation of BF rate (0-23 months)			Exclusive breastfeeding rate (<6 months)			Predominant breast feeding (<6 months)		
Characteristic	**%**	95% CI	p	**%**	95% CI	p	**%**	95% CI	p
Individual level factors									
Maternal working status									
Working (past 12 months)	43.2	[40.49,45.97]	<0.001	48.0	[43.23,52.75]	0.035	17.0	[13.29,21.37]	
Non-working	63.2	[57.15,68.93]		58.9	[49.92,67.39]		16.0	[10.12,24.47]	
Maternal education									
No education	41.7	[36.23,47.30]	<0.001	50.6	[41.94,59.29]		17.6	[11.74,25.78]	
Primary	45.9	[42.91,49.04]		49.8	[44.54,55.04]		17.2	[13.47,21.57]	
Secondary and above	62.7	[55.11,69.73]		47.8	[34.17,61.70]		8.6	[4.104,17.29]	
Partner's education									
No education	45.2	[39.65,50.83]	<0.001	50.3	[36.44,64.07]		24.3	[14.36,38.01]	
Primary	43.7	[40.77,46.64]		52.1	[47.05,57.03]		15.1	[11.69,19.23]	
Secondary and above	62.0	[53.78,69.60]		37.3	[23.76,53.23]		15.5	[7.766,28.65]	
Partner's occupation									
Non agriculture	54.9	[50.08,59.59]	<0.001	49.6	[42.05,57.24]		15.6	[10.78,21.90]	
Agriculture	41.4	[38.52,44.41]		50.7	[44.90,56.55]		18.1	[13.82,23.23]	
Not working	51.5	[43.70,59.26]		44.6	[32.33,57.64]		11.8	[4.373,28.06]	
Mother's age									
15-24years	43.5	[39.63,47.47]	0.027	50.4	[44.38,56.49]		17.0	[12.31,23.03]	
25-34years	49.5	[45.68,53.37]		50.4	[43.73,57.03]		15.3	[10.83,21.29]	
35-49years	43.5	[38.85,48.19]		47.5	[37.96,57.23]		19.5	[12.75,28.69]	
Marital status									
Currently married	45.5	[42.64,48.30]		51.0	[46.12,55.91]		17.3	[13.60,21.71]	
Formerly married (div/sep/widow)	47.0	[39.2,54.98]		42.1	[28.10,57.43]		16.8	[7.713,32.91]	
Never married	52.9	[44.58,60.98]		44.5	[32.09,57.53]		11.9	[4.40,28.23]	

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Birth order							
First-born	47.4	[41.98,52.88]		50.1	[41.42,58.79]	13.1	[7.191,22.59]
2nd-4th	47.9	[44.32,51.67]		49.9	[44.19,55.65]	19.0	[14.73,24.14]
5 or more	42.4	[50.91,58.96]		49.7	[42.44,57.01]	15.8	[11.16,22.07]
Preceding birth interval							
No previous birth	47.4	[41.98,52.88]		50.1	[41.42,58.79]	13.1	[7.191,22.59]
<24 months	40.6	[33.62,47.91]		55.4	[43.14,67.03]	22.0	[14.18,32.58]
>24 months	46.7	[43.67,49.82]		48.8	[44.08,53.70]	16.9	[13.48,21.14]
Sex of baby							
Male	44.8	[41.32,48.24]		50.2	[44.47,55.87]	17.9	[13.76,23.14]
Female	47.4	[44.02,50.81]		49.6	[43.51,55.71]	15.5	[11.47,20.72]
Place of delivery							
Home	34.0	[30.99,37.21]	<0.001	50.4	[43.59,57.22]	18.3	[13.88,23.82]
Health facility	57.7	[54.19,61.19]		49.4	[44.38,54.37]	15.2	[11.07,20.58]
Mode of delivery							
Non-caesarean	47.4	[44.60,50.29]	<0.001	49.5	[45.16,53.89]	17.3	[13.88,21.37]
Caesarean section	20.9	[14.12,29.79]		60.1	[40.33,77.14]	4.6	[1.21,16.26]
Type of delivery assistance							
Health professional	58.6	[55.02,62.26]	<0.001	51.1	[45.68,56.43]	14.9	[10.62,20.72]
Traditional birth attendant.	40.2	[34.34,46.37]		40.8	[29.14,53.54]	24.6	[15.41,36.96]
Relatives or untrained people	32.7	[29.35,36.29]		51.1	[44.00,58.05]	16.5	[12.26,21.87]
Antenatal Clinic visits							
None	52.5	[36.46,68.08]	<0.001	47.3	[17.12,79.59]	14.4	[3.594,43.15]
1-3.	42.3	[39.39,45.35]		48.9	[43.89,54.06]	17.5	[13.76,21.87]
4+	51.6	[47.87,55.41]		52.3	[45.13,59.31]	15.3	[10.50,21.86]
Timing of postnatal check-up							
0-2 days	54.9	[49.44,60.41]	<0.001	44.6	[34.89,54.74]	20.8	[13.06,31.58]
3-6 days	62.9	[53.53,71.32]		61.7	[41.52,78.61]	13.7	[4.598,34.17]
7+	51.1	[44.49,57.67]		42.8	[29.27,57.44]	20.9	[10.96,36.18]

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No check-ups (including missing)	41.7	[38.64,44.90]		50.9	[45.45,56.37]		16.1	[12.49,20.51]
Mother's literacy								
Can't read	38.9	[35.07,42.88]	<0.001	47.8	[41.59,54.16]		18.6	[13.80,24.68]
Can read	51.1	[47.73,54.38]		51.4	[45.66,57.02]		15.5	[11.75,20.25]
Mother's frequency of reading newspaper								
Not all	44.0	[41.22,46.88]	<0.001	51.0	[46.49,55.53]		16.8	[13.28,21.08]
Yes	59.8	[53.65,65.62]		41.4	[28.78,55.30]		16.8	[8.743,29.86]
Mother's frequency of listening radio								
Not all	41.5	[38.13,45.13]	0.003	53.2	[46.94,59.4]		17.0	[12.27,23.13]
Yes	50.4	[46.96,53.89]		46.1	[34.27,44.69]		16.7	[12.61,21.71]
Mother's frequency of watching TV								
Not all	44.1	[41.32,46.92]	<0.001	51.9	[47.11,56.57]	0.008	16.9	[13.40,21.24]
Yes	58.1	[51.50,64.42]		33.9	[23.61,46.05]		15.4	[8.335,26.73]
Mother's BMI(kg/m^2)								
<=18.5	48.4	[40.60,56.18]		54.8	[38.25,70.37]		15.4	[5.26,37.45]
>18.5	45.9	[43.15,48.57]		49.7	[45.24,54.05]		16.9	[13.39,21.02]
Household level factors								
Wealth Index								
Poorest (lowest quintile)	39.3	[34.56,44.22]	<0.001	58.3	[49.21,66.83]	0.028	16.9	[11.13,24.76]
Poorer	42.0	[37.14,47.03]		54.0	[44.94,62.87]		19.6	[13.21,28.11]
Middle	43.8	[38.64,49.07]		51.5	[42.35,60.52]		16.4	[10.53,24.54]
Richer	48.7	[42.19,55.26]		42.5	[33.80,51.61]		17.0	[10.85,25.70]
Richest (highest quintile)	62.9	[56.37,69.06]		37.0	[27.07,48.20]		10.9	[5.086,21.96]
Mother's decision in category								
None	43.1	[39.73,46.54]	0.018	46.6	[40.62,52.77]		19.2	[14.02,25.61]
One.	44.7	[39.85,49.71]		47.8	[37.41,58.46]		17.9	[10.94,27.82]
Two.	51.7	[46.14,57.21]		59.0	[48.10,69.10]		14.8	[9.053,23.18]
Three and more	49.5	[44.41,54.58]		52.9	[44.62,61.03]		12.1	[7.334,19.31]
Community level factors								
Residence								

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Urban	61.2	[54.61,67.47]	<0.001	40.3	[31.06,50.27]	0.034	12.4	[6.75,21.60]
Rural	42.2	[39.47,45.06]		52.2	[47.44,56.92]		17.9	[14.13,22.30]
Geographical Zone								
Northern	39.3	[33.99,44.94]	0.001	44.3	[36.74,52.08]	0.002	18.0	[11.37,27.24]
Eastern	36.5	[30.50,43.15]		66.5	[57.66,74.28]		17.1	[10.45,26.76]
Western	51.4	[44.97,57.68]		53.6	[40.87,65.85]		10.7	[4.96,21.40]
Southern Highlands	53.0	[46.95,58.99]		46.4	[36.39,56.71]		11.6	[5.96,21.61]
Lake	44.2	[36.53,52.17]		40.6	[25.90,57.23]		21.1	[9.46,40.53]
Southern	45.4	[35.66,55.53]		51.6	[36.76,66.24]		13.2	[6.28,25.67]
Central	52.1	[44.65,59.52]		48.9	[39.96,57.85]		19.7	[12.34,30.07]
Zanzibar	49.1	[44.23,53.90]		10.4	[6.218,16.73]		36.7	[29.52,44.57]

Note: BMI, body mass index; CI, confidence interval; TV, television. Chi-squire test was applied to test for statistical significance.

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Table 4: Unadjusted and adjusted Odds Ratio (OR) for delayed initiation of breastfeeding, non-exclusive breastfeeding and predominant breastfeeding in Tanzania 2010

Outcome variable	Characteristic	Unadjusted odds ratios			Adjusted* odds ratios		
		OR	[95%CI]	*p*	AOR	[95%CI]	*p*
Delay initiation of breastfeeding							
	Mother's age						
	15-24 years	1.0			1.0		
	25-34 years	0.7	[0.61, 0.91]	0.003	0.6	[0.52, 0.81]	<0.001
	35-49 years	0.9	[0.76, 1.26]		0.7	[0.55, 0.94]	0.016
	Work status						
	Not working	1.0			1.0		
	Working	2.5	[1.88, 3.31]	<0.001	2.3	[1.62, 3.29]	<0.001
	Mother's education						
	No education	1.0			1.0		
	Primary	0.8	[0.65, 1.09]		1.0	[0.77, 1.32]	
	Secondary or more	0.4	[0.26, 0.60]	<0.001	0.5	[0.33, 0.83]	0.006
	Place of delivery						
	Health facility	1.0			1.0		
	Home	2.8	[2.26, 3.38]	<0.001	1.7	[1.09, 2.62]	0.020
	Mode of delivery						
	Non-caesarean	1.0			1.0		
	Caesarean section	3.2	[1.91,5.35]	<0.001	8.9	[4.72,16.79]	<0.001
	Delivery assistant						
	Health professional	1.0			1.0		
	TBA	2.2	[1.65,2.99]	<0.001	1.4	[0.82,2.28]	
	Relatives/others	3.0	[2.42,3.77]	<0.001	1.9	[1.21,3.08]	0.006
	Area of residence						
	Urban	1.0			1.0		
	Rural	2.2	[1.62,3.10]	<0.001	1.4	[1.00,2.03]	0.047

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	Geographic zone						
	Western	1.0			1.0		
	Southern Highlands	1.0	[0.67,1.43]		1.1	[0.70,1.65]	
	Central	1.0	[0.69,1.54]		1.2	[0.81,1.76]	
	Lake	1.4	[0.92,2.21]		1.6	[1.02,2.45]	0.042
	Southern	1.5	[0.87,2.45]		1.6	[0.94,2.73]	
	Northern	1.6	[1.13,2.34]	0.009	1.7	[1.14,2.46]	0.009
	Zanzibar	1.1	[0.80,1.55]		2.3	[1.48,3.68]	<0.001
	Eastern	1.9	[1.26,2.80]	0.002	2.1	[1.37,3.26]	0.001
Non-Exclusive breastfeeding							
	Child age in months (<6 mo)	1.9	[1.65, 2.18]	<0.001	2.1	[1.78, 2.40]	<0.001
	Delivery Assistance						
	Health professional	1.0			1.0		
	Relatives/other people	1.0	[0.69, 1.47]		1.4	[0.82,2.23]	
	Traditional birth attendants	1.7	[0.98, 3.07]	0.050	2.3	[1.15, 4.57]	0.019
	Area of residence						
	Rural	1.0			1.0		
	Urban	1.5	[0.89, 2.36]		2.1	[1.08, 3.89]	0.028
	Geographical Zone						
	Central	1.0			1.0		
	Eastern	0.4	[0. 19,0.66]	0.001	0.3	[0.17,0.62]	0.001
	Western	0.7	[0.37,1.39]		0.6	[0.32,1.28]	
	Northern	1.1	[0.68,1.86]		1.4	[0.73,2.77]	
	Southern Highlands	1.1	[0.65,2.02]		1.6	[0.84,3.13]	
	Southern	1.0	[0.43,2.17]		1.4	[0.50,3.64]	
	Lake	1.4	[0.58,3.58]		2.6	[0.91,7.29]	
	Zanzibar	8.0	[4.01,15.79]	<0.001	10.8	[5.23,22.22]	<0.001

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Predominant breastfeeding							
	Geographic Zone						
	Western	1.0			1.0		
	Southern Highlands	1.5	[0.45,4.82]		1.5	[0.45,4.82]	
	Southern	1.6	[0.47,5.68]		1.6	[0.47,5.68]	
	Eastern	1.8	[0.57,5.38]		1.8	[0.57,5.38]	
	Central	2.4	[0.79,7.17]		2.4	[0.79,7.17]	
	Northern	2.3	[0.76,6.82]		2.3	[0.76,6.82]	
	Lake	2.6	[0.61,11.03]		2.6	[0.61,11.03]	
	Zanzibar	4.8	[1.76,13.22]	0.002	4.8	[1.76,13.22]	0.002

Note: chi-squire test was applied to test for statistical significance. The independent variables adjusted for included child sex, child age, mother's age, mother's literacy, mother's employment status, mother's BMI, marital status, father's education, father's occupation, birth order, preceding birth interval, antenatal visits, postnatal visits, mother's access to media (radio, television and newspapers), household wealth index, area of residence and geographical zones.

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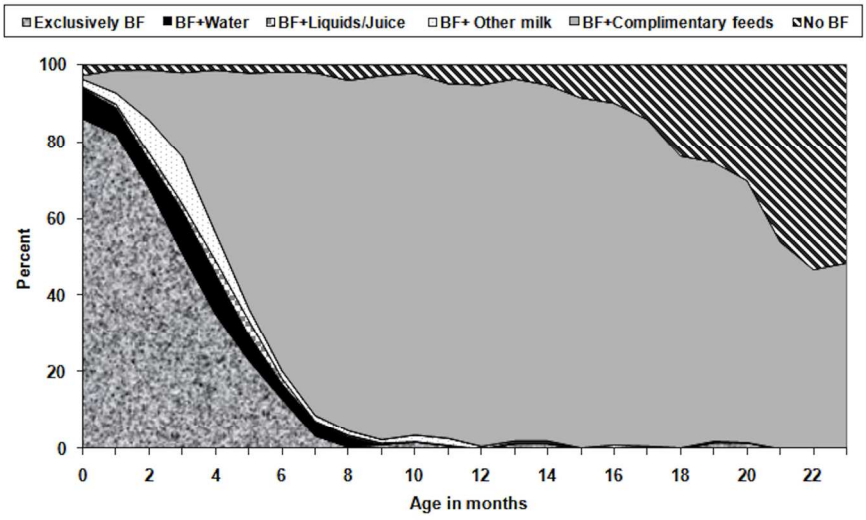

Figure 1: Distribution of children by breastfeeding status according to age

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